THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. A. J. THYNNE, M.L.C.,

SECRETARY FOR AGRICULTURE.

EDITED BY A. J. BOYD, F.R.G.S.Q.

VOLUME I.

JULY TO DECEMBER, 1897.

By Authority:

BRISBANE: EDMUND GREGORY, GOVERNMENT PRINTER.

1897.

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VOL. I., PARTS 1–6.

GENERAL INDEX.

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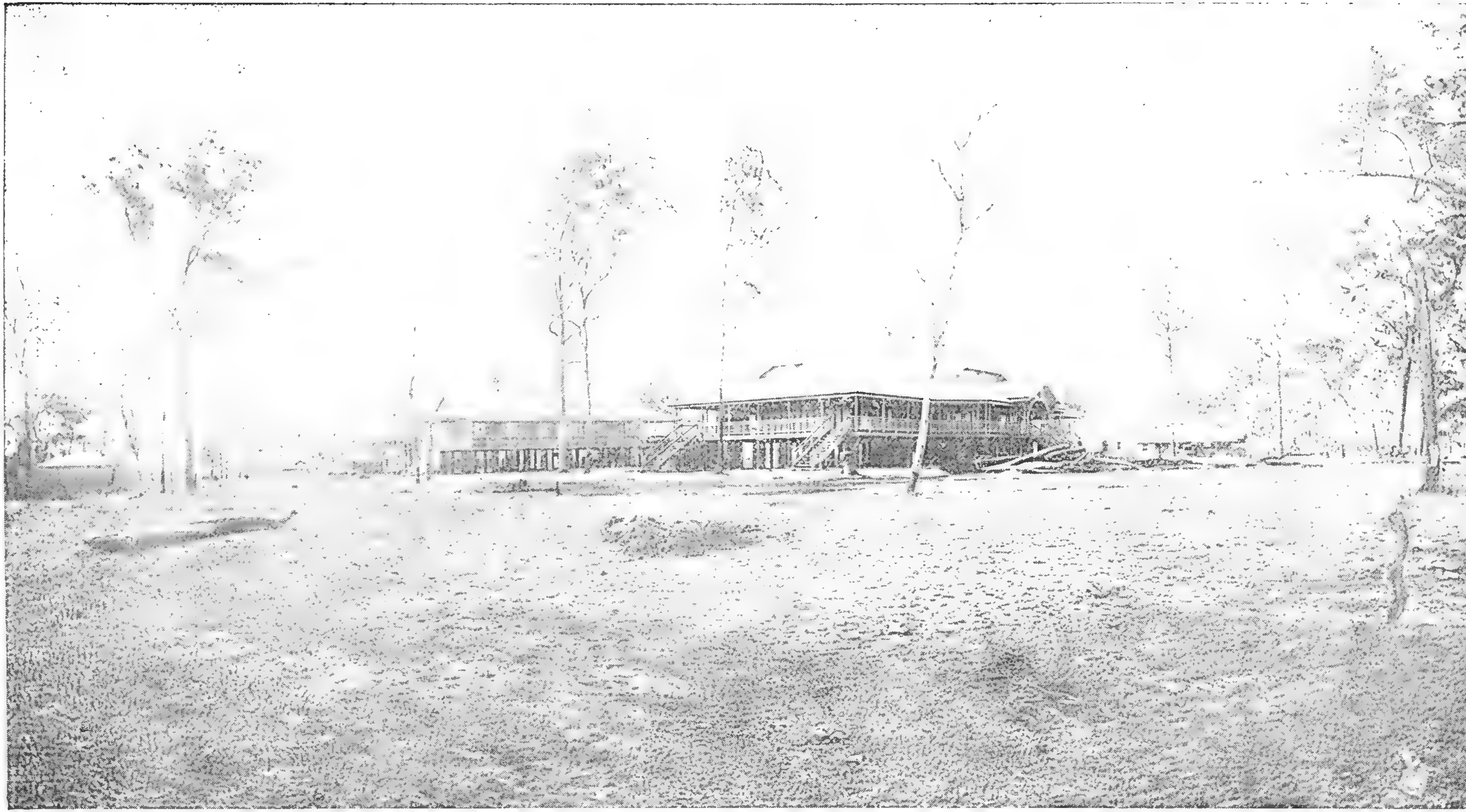


GENERAL VIEW OF THE AGRICULTURAL COLLEGE—GATTON.

CONTENTS.

TO OUR READERS.

To all those who have the welfare of Queensland at heart, and who therefore watch with interest the industrial progress of the colony, it must be a subject of the greatest gratification to note the steady advance of the agricultural interests throughout almost the whole of this vast and fertile territory.

A retrospect of the operations of the settlers in the agricultural and grazing districts during the past decade, and especially during the latter half thereof, must convince even the most sceptical and most pessimistic amongst our community that the tillers of the soil, and all who gain their living by industries connected directly and indirectly with farming and grazing, have at last awakened to an intelligent sense of the magnificent inheritance which is theirs in the soil, the forests, the plains, and the climate of this gem of the Australian colonies, this vast country with its illimitable resources, so long lying dormant, so long awaiting the advent of those who to-day are bringing all their energies to bear on developing these resources, and who have already succeeded in showing that the plough and the voice and the pen of the scientist are mighty levers which are operating to bring the great agricultural industries of Queensland to the front, and are making them what they should be—the most important and wealth-producing of all our industries.

It has ever been the aim of the Agricultural Department of Queensland to afford every possible aid to those engaged in agricultural pursuits.

In times past, with the limited resources at the command of those entrusted with the working of the Department, much was accomplished in the way of importing new varieties of fruits, cereals, seeds, plants, implements, &c., and by the publication of useful pamphlets bearing on matters of interest to farmers and fruit-growers. These were widely distributed, and effected their purpose fairly well.

But it remained for the Government to recognise the great importance of the industry, and to set practically to work to raise it to a high standard of efficiency. Experts have been engaged to carry their technical and practical knowledge to the very doors of the settlers. Thus all agricultural interests are being promoted and fostered by practical instruction from men of high attainments in their several vocations, and by the establishment of an Agricultural College and Experimental Farms from which it will, it is hoped, be found that much interesting and practical information will be periodically distributed throughout the colony. These institutions, especially the College, will to a great extent practically settle the question how to make country life attractive to the youth of the colony.

In order still further to assist the agriculturists, it has been determined by the Minister for Agriculture to issue this Journal, which will supersede the late spasmodic publication of special Bulletins.

Essentially of a utilitarian character, the *Queensland Agricultural Journal* will be devoted mainly to the publication and wide dissemination of articles of a popular educatory nature. It is not intended that it shall take the place of an agricultural newspaper, nor that it shall in any way interfere with the peculiar work of such journals.

This first number will afford a fair idea of the nature and partly of the scope of the publication, which will be issued on the first day of each month, and will be posted gratis to the addresses of members of agricultural, pastoral, and kindred societies.

Some Things we Need.

WITH the publication of this, the first number of the *Queensland Agricultural Journal*, the Department enters upon a work which, it is hoped, will prove of great assistance to all those engaged in production from the soil. The occasion seems a fitting one for a short review of the present position of agriculture in Queensland, a sketch of the aims and objects of the Department, and some reference to the means by which the fulfilment of these aims and objects may be promoted.

In such branches as sugar and bananas, we are exporters to other colonies, where we have to meet the competition of other countries. The output of sugar has not yet quite reached Australasian consumption. Bananas are still imported to the southern colonies from Fiji and other places in the Pacific. In both those products we have had to meet a fall in prices, which are now very much lower than growers were receiving when they had only sufficient, or less than sufficient, for local requirements. In sugar especially, the competition is now very keen, and in order to exclude Javanese sugar from Australia, the prices offered for Queensland sugar have been depressed to a point which makes the future of that industry, under present conditions, a matter of some anxiety, and the time has certainly come when the strictest economy will have to be enforced in every direction in order to secure the safety of the industry.

In most other farm products we are, or have until very recently been, importers to a considerable extent. The local market, aided by Customs duties, is generally favourable to the producer. But to make this a great agricultural country, such as its soil, climate, and other advantages have fitted it to become, producers must ere long prepare to face competition with other countries in the markets of the world, and they must also regard present local prices as unsafe guides for calculating probable returns in the near future. In wheat, for instance, in spite of the high average yield per acre, and of the high price realised as compared with the yield and price obtained in other countries, we are far from meeting our own requirements. There is now an influx of experienced farmers from elsewhere, and the volume of wheat production bids fair to increase greatly. And the time is not far off when the growers of wheat, as well as of many other products, will have to carefully study questions of very strict economy indeed in order to secure for themselves a margin of profit as remuneration for their work.

In all products which we now only partially supply to ourselves, agriculture is in a transition stage, or on the eve of it; and it behoves us to look well ahead, and prepare now for the completion of the process of change which will assuredly test to the utmost the capacity of the country and its people to resist strong competition.

If we take stock of our materials, we have nothing to fear in point of soil or climate. On the contrary, these two important factors are as favourable to us as can be desired, and they are of extreme value. There is no better soil anywhere than we have lying at our hands largely unoccupied, and under our favourable climate two good crops each year can generally be obtained.

The full utilisation of these advantages depends upon our farmers and on the means they employ.

But there are farmers and farmers. It would be invidious here to single out any individuals as representatives of the type of skilled and successful farmers. The skilled farmer who studies his surroundings, and by means of his skill and experience overcomes all difficulties in the way of his success, is

happily to be found in every farming district in the colony, and skill with industry generally spells success. But, on the other hand, there are farmers who have settled on our lands without adequate previous training, and who frequently are discouraged by failure in the face of hard work and earnest endeavour.

If the skilled and successful farmer has need to prepare for the coming struggle for a place in the markets of the world, how much more so is it necessary for the comparatively inexperienced farmer to sit down and think out the problem of the early future?

It is at this stage that the Department of Agriculture has come into existence, and such is the condition of affairs that it has to cope with. Its creation is a clear intimation that the people of Queensland desire it to become a great agricultural country, able to sustain a successful struggle with all other countries whose competition it has to meet. That is concisely the aim and object of all Queenslanders who have faith in the enduring prosperity of the country.

The first duty of such a department is to take the initiative in agricultural education. To provide it for the young people growing up, is only part of the work. If the education is confined to the young, the process of improvement of agriculture will be very slow in producing good results. But for them it is of extreme importance, and should be of the best possible character. Provision must also be made for spreading knowledge amongst those older in life. There is no agriculturist living that has not something more to learn, and with us the varying degrees of skill and knowledge possessed by our existing farmers open a wide field for the labours of the specialists and instructors of the Department. And then comes a new class of settlers from other countries and colonies. They have had no previous local experience, and without the early guidance of competent men they would be liable to make mistakes involving serious loss. For immediate purposes the supply to these men, as well as of a large proportion of our older settlers, of reliable information as to the best crops to grow and the best way to treat them, is an urgent necessity. The Department must lend its energies to meet the requirements of all classes, young and old.

It is not proposed to make any special reference here to the teaching of the principles of agriculture in our common schools, though much might be done in that way. Beyond advising the Department of Public Instruction, the field of operation of the Department of Agriculture is necessarily somewhat limited at present. By-and-by it may be feasible to give some of the State school teachers in agricultural districts courses of practical instruction, which would aid them in imparting to their pupils at least a desire to learn the principles of agriculture.

For the present, however, there is some provision for the training in both practical and scientific agriculture of youths at the Gatton College. The Department is prepared to make ample provision for accommodating all suitable candidates for admission to it. The best teachers obtainable have been engaged, and the course of study is wide enough for all purposes. Students who complete the course will have a sound general knowledge, and they may be expected in their turn by example, if not by precept, to aid in the dissemination of their own acquired knowledge. They will be able to fill, when required, positions of trust in the Department as overseers of State farms, and otherwise, and when they commence farming on their own accounts their farms will be, it is hoped, only a degree less useful object lessons to their neighbours than State farms would be.

After the College, which will serve many useful purposes for experimenting as well as teaching, come the State farms, some of which are already in existence in preparatory stages, and others in early contemplation. At these, every obtainable variety of seed and crop likely to be suitable for successful culture in each district will be tried and rigidly tested, and the results made known by ocular demonstration to visitors and by the publication periodically of the

results achieved. The rearing and feeding of stock and the manufacture of general farm and dairy produce will not be overlooked. Experience has amply shown that in agriculture especially "seeing is believing," and that "an ounce of practice is worth a pound of theory" in relation to the effect in bringing conviction to the mind. But it is not only to the neighbouring farmer that a State farm will prove useful. Each State farm will naturally become more or less specialised for the particular products found most suitable for its district. Students who have gone through a general course at the College will have the opportunity of entering a State farm or a sugar experiment station for a course of special experience in some particular line of agriculture. And it may be possible, until such time as such students are ready to enter the State farms, to admit a limited number of youths as assistants to gain some practical experience in the particular classes of cultivation to which they are mainly devoted.

A competent chemist has been engaged by the Department for the conduct of necessary analyses and to supervise the teaching of the important study of agricultural chemistry at the College. As required, further chemical assistance will be secured. A complete laboratory is being provided at Gatton for the purposes of general departmental work, and a separate outfit for the teaching purposes is under way. Promising students in chemistry will have an opportunity of devoting themselves specially to that subject.

Specialists in several branches of agriculture are available as travelling instructors in farming districts, and others are to be added. The Department has in its staff a body of specialists in the practical fruit-growing and dairying and in the sciences of botany, entomology, and bacteriology, which is not surpassed by any similar body of men in any colony of Australasia; and when the specialists in tobacco and coffee-growing and wine-making now in contemplation are added, great and enduring results from their work may confidently be anticipated.

But however excellent the teaching power or arrangements of the Department may be, however ready the people of the country, both young and old, to acquire the knowledge offered to them, no grand results can be achieved without the help of the farmers themselves. They must be taught as their first lesson that if they desire the help of the Department they must as a body set to themselves the task of helping themselves and helping it. To do so effectively, they need to combine together much more than heretofore. It is not possible to have high-class specialists in such numbers as to provide for individual visits to every farm in the colony. Local wants and local questions are best made known by associations of local people, who are thereby enabled to give united expression to them. If the general body of farmers in any locality are unable for any reason to meet and give united expression to their wants or opinions, or if they are divided amongst themselves, their influence for the good of their district must necessarily be lessened, and to no section of people should the adage "United we stand, divided we fall" more strongly appeal. At a few places in Queensland the combination of local farmers has been productive of great benefit, but as a rule there is no section in the community more disorganised. The associations for show purposes are of some benefit; they are general throughout the colony, but as a rule their efforts begin and end with their annual shows, which are held quite as much in the interests of the townspeople as of the farmers. The holding of shows ought to have only a secondary place in the objects of farmers' societies. Useful as these shows may be in the opportunities they offer for mutual intercourse, inspection of new machines, comparison of products, and in providing a well appreciated annual holiday, the benefits they confer on the farmer are but small compared with those derivable from union for objects of greater importance.

At every meeting-place of farmers, complaints are heard of the difficulty of disposal of their produce, the delays and expense of transport, the high interest on borrowed money, the expense and difficulty of getting good implements, and the high price of such necessaries as they cannot themselves produce, and

many other similar matters. Many are inclined to look upon the Government as a sort of providence from whom all good things ought to come, and who should step into those fields of occupation which rightfully belong to individual enterprise. Some even urge that the Government should undertake the agency of the sale of their produce, the lending of money, and all the other functions which they think are not now satisfactorily discharged by individual enterprise. In the adoption of any such ideas by a Government, there lurks untold danger, and no section of the community would be exposed to greater danger than the farmers themselves. It speaks well for past administration of State affairs when people seek to add to them the discharge of such functions. It is not long since any attempt by Government to extend its tentacles into the private affairs of individuals would have been regarded as a deep design against the liberty of the subject, or a scheme by which it might acquire the power to crush or oppress them; and there is no saying when a state of affairs might arise when the temptation to use such a force might be too strong for resistance.

The remedy for any such evils as really exist is mainly in the hands of the farmers themselves. Those who need their products must buy them; those who have money to lend to them or goods to sell must come into the market to lend or sell. Without practical or effective union on the part of the farmers, they are individually so weak that they cannot protect themselves. With union, they can become so strong as to be able to control within reasonable limits the markets in which they deal; without union, they are unfitted for taking part in a successful struggle for the capture of foreign markets. With union, they can equip themselves with all the means by which they may exclude foreign competition with their own products in their own markets; without union, their voices sound as discordant as those of Babel in the ears of a deafened and distracted Agricultural Department. With union, they can readily convey their sentiments to the intelligence of a sympathetic Minister or officer of his Department, and secure the removal of obstructions to progress, the adoption of improvements, the passing of good laws, and finally, the raising up of agriculture as a pursuit, to the very high level to which it naturally ought to belong.

By whatever term this necessary union may be called, its general effect upon the individuals comprising it is of immense good. Its direct material advantages are great, and its moral effect in the development of a spirit of independence and self-help, and at the same time of mutual support to each other, is none the less great.

Local farmers uniting for these objects, having representatives upon larger district associations, which in their turn have representatives in a periodical gathering of the leading agriculturists of the colony, would give greater help to the development of the agricultural interests of Queensland than can ever be possible under present conditions. And they would also furnish a more suitable and effective channel for the spread of the collected information of the departmental staff than all their lectures or bulletins heretofore in vogue could possibly be.

To sum up the whole matter, the objects the Department now chiefly desires to promote are:—The education of both young and old in the technical knowledge of agriculture, and the formation of associations or bodies of farmers both for the attainment of objects of material importance to their welfare, and for providing an adequate means of giving expression to the general sense of that important section of the community.

Organisation amongst Farmers.

"UNION is strength." In other words—"United we stand, divided we fall." The truth of these aphorisms has been demonstrated over and over again. By union, be it remarked, we do not imply combinations of men of any particular calling which bring them into antagonism with other men, which impel them to defy authority and set themselves up as the arbiters of the destinies of a country.

The union we advocate is that which binds men of different trades and callings to work together not only for their own benefit but for the common welfare of the community at large. Such unions are productive of great blessings to a country, and amongst no classes of workers is a union more desirable than amongst the tillers of the soil.

In this colony there are, and have been for the past thirty years, associations of farmers, graziers, fruit-growers, and others whose object at the outset has been to benefit their members by effecting as a body what would be impossible to, or at least difficult of attainment by, each individual separately.

Of the many associations of former years, the East Moreton Farmers' Association approached nearest to the ideal union. Farmers met regularly once a month, papers were read and discussed, exhibits of various kinds of produce were laid before the meetings, and emulation was stimulated by the successes of individual members. Ploughing matches were regularly held, and the interest taken in the meetings was such as to create a bond of real union, which resulted in raising the status of the farmers, and instilling into their minds ideas calculated to bring agriculture to its proper level amongst the industries of Queensland. Of late years, although we find unions under the name of societies in all the agricultural centres, it is regrettable to observe that the work of these societies tends mainly to one end—a show.

Now, agricultural shows are very excellent things in their way; but surely this is not the only object for which societies should exist. We hold that there are greater issues involved in an agricultural union than the mere holding of a show.

The Agricultural Department has laid itself out to obtain the services of the best experts in the various fields of agriculture, in which term we include all the branches of the science (for agriculture is to-day recognised as a true science).

The labours of these scientists, especially of the chemist, the entomologist, and the bacteriologist, could be made productive of the highest results if the farmers were regularly organised into unions, with a regular meeting-place at each centre, with an efficient secretary, through whom meetings with the farmers might be readily arranged.

To-day, when so many diseases, fungoid and parasitic, have to be contended with, the Government Entomologist is invited to visit a district. He finds himself under the necessity of visiting individual farmers and of obtaining from each the data upon which to found his subsequent investigations. If this work could be done for him by a society in the district, his labours would be simplified, his deductions could be placed before the society as a body, and thence disseminated by leaflet and pamphlet throughout the district. The society, union, or association—call it by what name we please—becomes a body, as the *Mackay Sugar Journal* says, "speaking for hundreds of farmers." And, to again quote that journal, "The farmer who to-day does not belong to a union is an isolated unit, who has forgotten to insure himself against adversity; and the district without a union is one that offers few attractions to the newcomers or to the men already in it."

We should like to see all the farmers in every agricultural district form themselves into unions which, although separated by geographical conditions, would, by their combined action, become a powerful element in the dissemination of sound views of the real needs of their high calling, and help materially in the removal of obstacles to progress and generally in the promotion of their common benefit.

Each local union would study the requirements of its district, and at the meetings of representatives, such as that of June last at Gatton (and which it is hoped will be held at least once in each year), the discussion by competent men of specially considered subjects could scarcely fail to make due impression upon the opinions of members of the Government and of the Legislature and upon the people of the colony generally.

We trust that ere long we shall be able to record a large increase in the membership as well as a general extension of the field of work of these associations throughout the whole of Queensland.

A Paying Crop for the West:

A CHAT WITH WESTERN FARMERS.

By HENRY A. TARDENT,

Manager Westbrook Experimental Farm.

A few years ago it was generally admitted that agriculture could be carried on successfully only on the coast. The West was the Never-Never country—a barren desert, hardly fit to rear sheep on. Those prejudices were not seldom shared by some farmers of the West themselves, who wrongly tried to grow in that country crops not adapted either to the soil or to the climate. Maize, for instance, is being planted year after year in thousands of acres, although it is there a most unreliable crop. It cannot be denied that here and there fair crops of excellent corn have been gathered, but taken on an average it does not pay. It requires from 15 to 20 inches of rain annually to grow a crop of corn to perfection. That amount of rain is never obtained within the three or four months wanted to bring a crop of corn to maturity. Cultivators of maize seldom get even the few showers which are absolutely necessary at flowering time for the flowers to set. Hence too many cobs badly shaped and imperfectly filled.

Similar drawbacks exist for many other crops.

What then is to be grown in the West?

We may produce a good many crops which pay very well indeed and grow there much better than on the coast land; amongst others, wheat and grapes and a great variety of fruit-trees. But these may be some day spoken of more in detail in subsequent numbers. To-day the writer would like to draw attention to the very crop wanted in order to enable farmers to become *successful* farmers. It is not difficult to grow. It can be planted from September to December inclusive, and can be gathered as required from Christmas to September, during eight months. It is a most wholesome and acceptable food for man, for pigs, for poultry, for horses, and for cattle. It gives on an average from 6 to 8 tons of product per acre, worth for any of the above uses at least £5 per ton, which means a return of from £30 to £50 per acre.

From official statistics it would appear that the average crop of sweet potatoes is, west of the Range, 1¾ tons per acre. The figures must no doubt be accepted as correct, but experience shows that this weight can be enormously increased by the exercise of a little science and a great deal of common sense. At Roma, a typical Western district some 320 miles west from Brisbane, the writer has grown, year after year, rows upon rows of sweet potatoes, giving on an average half-a-stone in weight per plant. With some 8,000 plants to the acre, this means 25 tons per acre. Of course on a large scale it never comes to that, there being always misses and some weaker plants. But the writer is well assured of having reached 15 and 16 tons, and has often filled many bags with tubers varying between 5 and 15 lb. each. At the 1894 show he exhibited one tuber weighing 29 lb., which is the record for the West, if not for the whole colony.

This has, however, not been the general experience of Western farmers, for the reason that they adopted unskilled methods of cultivation.

The only thing required in order to grow sweet potatoes to perfection in the West is a *hotbed.*

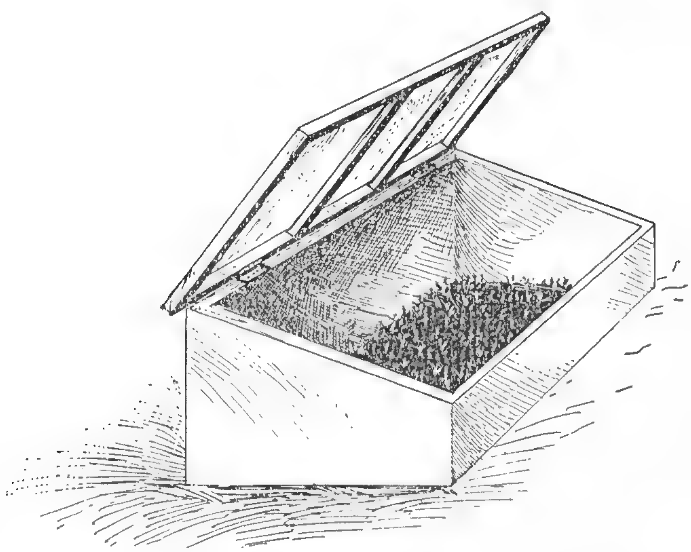
Farmers, of course, know that sweet potatoes are not planted like the English potatoes, for which whole tubers or simply eyes are put in the ground. For sweet potatoes it is the *shoots* from the tubers which have to be cut off

and transplanted one by one into the ground. Now, the sweet potato is exceedingly sensitive to cold. The slightest frost will destroy the vine (as the stem is called). Consequently if in order to get shoots the tubers are simply put into the ground, they will remain dormant until the frost is over. Then the shoots will grow *slowly*, and only become long enough to be transplanted after six or eight weeks. This brings the planter right into the middle of summer—a bad time to transplant anything. Unless there occur abundant showers, seldom to be had at that time of the year, the transplanted shoots will have great difficulty in setting roots. They will either die out or remain weak and sickly, and, in fact, never get strong enough to give good healthy tubers. But with a supply of strong, vigorous shoots, from 8 to 12 inches long, ready to be transplanted in the open field as soon as the frosts are over, then these will set roots at once. Being well rooted and provided with a bushy, luxuriant vine, when the November storm-rains come, they will then start swelling, bursting the ground in every direction. And when the time is come to dig them out the crop does not consist of small potatoes, but at every plant are found potatoes the size of footballs.

The only way to get your shoots in time is to put your tubers in a *hotbed*.

Over 4,000 years ago, the ancient Egyptians knew how to make *manure hotbeds*, not only for raising early plants, but also for hatching chickens artificially, as we of the present day do in our incubators. And those hotbeds are not difficult to build.

Select a small piece of well-drained land, if possible sheltered in some way against southern and westerly winds. Dig there a ditch or trench from east to west, 3 or 4 feet wide, 1 foot deep, and as long as is required, taking into consideration that a square yard of it will give you at least 2,000 shoots for transplanting. Now take 1-inch boards or sawn slabs and build over the ditch a sort of box 1 foot high on the northern side (in Australia) and at least 18 inches on the southern side, joining them at both ends with slanting boards as shown in the accompanying diagram.



Shovel back the excavated earth towards the box. Over the box fit a kind of frame of the same dimensions; fix it with *hinges* to the top of the 18-inch board, so that it can be opened and shut easily. As glass frames are expensive it will suffice to simply nail ordinary tent calico on to the frame.

Next obtain a quantity of stable manure, mix it well with nearly the same quantity of chaffed straw; this is necessary to avoid an *excessive heat* and to maintain a *warm* temperature much longer. Now shovel it into the ditch

and box in the bed in 6-inch layers as evenly as possible, trampling it well down at the same time. Give a good watering with the watering-can. Add new layers in the same way until the whole is from 18 to 20 inches thick, and water again. Over this put a couple of inches of *light soil* and on it *spread evenly* the middle-sized or even small tubers, leaving only from ½ to 1 inch space between them (there will be from 100 to 150 tubers to the square yard). Cover them with 2 or 3 inches of light sandy loam and shut the lid.

The preliminary work is now done. All that remains is to await the results. They are simply marvellous. In His wisdom and kindness, the Great Author of Nature has, invisible to the eye, myriads of little helpers which, being now placed in condition favourable for their development, come into life, multiplying with an incredible rapidity. Those tiny organisms are as useful on a farm as herds of domestic animals. They set to work at once, transforming entirely the substance in which they are born. The transformation (or fermentation as it is called) is, like all chemical processes, accompanied by the disengagement of various gases and the production of a considerable quantity of *heat*. This heat will at once waken up the germinative power dormant in the tubers and keep them growing. In the middle of the day, when the temperature is warm, lift, at first slightly and then entirely, the cover (lid) to let the plants get accustomed to the ordinary outdoor air; but great care must be taken to keep the hotbed covered at night, otherwise the shoots will surely get frozen and the whole work will be wasted.

Now about transplanting.

The best soil to grow sweet potatoes in is a rich, well-drained, friable, alluvial soil, and next best a rich, friable, well-drained scrub loam. If the soil is not naturally like the above it must be made so by the use of ploughs, scarifiers, manures, and fertilisers. Nothing less than a 12-inch depth of the above soils in a perfectly pulverised state will satisfy the gross appetite and greedy propensities of the sweet potato. The land must not be laid in ridges, as is done—for good reasons—on the coast, but must lie as flat as possible.

When the last frost is over—in the greater part of the West this is usually about the middle of September—and when the shoots are no less than from 8 to 12 inches long, then is the time to transplant them. If the shoots are pulled out or broken close to the tubers no more will grow, but if they are cut with a curved knife about 2 inches underground, the part left in the soil will continue to grow and give a new shoot in a very short time. By adopting this plan as many as four shoots may be obtained in succession from a single eye, and thus transplanting may go on from the middle of September till the middle of December. It pays—and the work is quickly done—to strip off from the shoots the side leaves and branches, leaving only a few leaves on the top end. Then make a dibble—not a blunt, clumsy one, but a light one, as sharp as a spear. An old buggy-wheel spoke cut to 14 inches long makes a fine easily penetrating dibble, especially if it is well sharpened, the end being slightly burnt on the fire and well greased. Select if possible a cloudy day. If there are none, it is better to do the planting towards the evening. If there is moisture in the ground no watering is required. But if the ground is dry it is absolutely necessary to give from one pint to one quart of water to every plant. The distance between the rows ought to be 3 feet, and in the row 18 inches for the White Maltese and kinds similar to it. But for the Rosella with long rampant vine and scattered tubers it ought to be 4 feet between the rows and 2 feet in the row. No planting is good enough which is not done along a well-strained line. Plant the shoots, or cuttings as they are called, one by one along the line, taking care to plant the dibble in a slanting way in the direction of the line. Lift it a bit, then with the left hand set under it the greater part of your shoot, leaving no more of it than 2 or 3 inches above ground. Pull back the dibble, plant it a second time 1 or 2 inches further, and with it press firmly the ground all along the cutting, beginning from bottom up. It is a little bit tedious work. Still, when one has got the knack one can plant in that way frome one-third to half-an-acre per day.

Planting them with the plough results in failure, and the non-success may be attributed to the fact that the soil cannot be pressed firmly enough around the cuttings.

If the work is well done and the weather favourable, in twenty-four hours the cuttings will have set rootlets from $\frac{1}{4}$ to $\frac{1}{2}$ inch long, and in less than a week they will be well rooted.

The first implement to use a few days after planting is the single-horse Ajax lever harrows, with the teeth *slightly* reversed. Then when the rows are easily seen, keep the Planet junior's scarifier at work, at first as deep set as possible, then gradually shallower. Supplement its work close to the rows with the hand Planet junior's hoe (especially with the two curved knives and the two little rakes), an implement indispensable to the farmer who intends to succeed on the land. In short, keep the land perfectly free from weeds until the vines are bushy enough to cover it entirely, then let well alone.

With favourable weather, in less than three months the field will appear like an uninterrupted ocean of green, with here and there a few bluish flower-bells. By digging carefully at this time a few tubers may be obtained here and there. Break them off cautiously, and carefully cover up again the denuded roots.

For the main crop wait till the fall. Cut away the vines, say, with a reaping-hook; let them dry, and store away. They make a fair hay, and will be relished by both horses and cattle during the cold frosty winter. For digging by hand, the best implement is a mattock or a very strong double-pronged hoe. With them dig *on the side* of the row until the tubers are well denuded. Then pull out the whole of the tubers, which, in the White Maltese, hang like a bunch of carrots all round the collar of the plant. Shake the earth off and let them dry up a bit before bagging and marketing. A strong plough able to pass under the tubers and drawn by two horses, one on each side of the row, saves a good deal of labour.

No disease of any kind has yet, to the writer's knowledge, attacked the sweet potato in the West. Still there are in its cultivation at least two serious drawbacks to contend against. The first consists in the fact that many plants do not give any tubers—remain bare, without any apparent reason for doing so. This can be to a certain extent accounted for by the frequent changes of tubers for raising shoots. It is probably also the result of the propagation of the *Batata* for centuries *by cuttings only*, which means that the same plant has lived for centuries. This cannot result in anything but the gradual exhaustion of the fruiting, or rather *tubering* power. The remedy must apparently be looked for in the raising of new varieties from *seeds*. If Mr. Soutter, of the Acclimatisation Gardens, who is possessed of the necessary knowledge, the hot-houses, bush-houses, &c., would kindly do for the sweet potato-grower what he did for the sugar-cane and pineapple growers, he would confer a great boon on the whole colony.

The second drawback is found in *caterpillars*. They seem to appear at any time during the summer—sometimes once, sometimes twice in a season. Not seldom they appear in millions, eating away acres in a single day as bare as could be done by a flock of goats. This last season they have been especially bad on the writer's 5-acre block, a considerable part of which they destroyed in two or three days. Paris green mixed with powdered lime or ashes, and shaken in the early morning or after a shower on the plants from a thinly-woven bag, is sure to kill them; but it is decidedly objectionable and dangerous to have acres of poisonous powder on a place where animals, people, and especially children live. In that case the only way is to put a pair of scissors in every available hand on the farm, and to go along the row cutting in two every caterpillar. This is laborious work, but with the assistance of birds is effective.

The best variety of sweet potato to grow is undoubtedly, so far as is known at present, the *White Maltese*. Its flesh is white, mealy, and savoury. The tubers, being elongated, sink deep in the ground, which enables the plant to stand the drought remarkably well. During the last terrible season, the

author kept them for four months growing and prospering without a single drop of rain on them. The next best is the *Rosella*, which appears to the taste sweeter than the former, but is less mealy. The objections to it are that the largest tubers grow not seldom a few feet from the main stem, to which they are united by a very thin root indeed, whilst a number of small tubers grow here and there where the adventitious roots have struck into the ground, which causes a great many tubers to be injured by implements when being dug out. The writer recently introduced in the West a few new varieties, like the General Grant, the Spanish Giant, the vineless *Batata Ypomea*, &c.; but his experience of them is too limited as yet to permit him to express any opinion on their respective merits.

There is no plant which can be put to such a variety of uses as the sweet potato. The tender shoots form a very palatable vegetable when treated exactly like asparagus. The young leaves, first boiled, then chopped down and fried in butter, and served with boiled eggs cut into halves, form an excellent substitute for spinach. Those two dishes, being digestible and slightly laxative, are especially to be recommended to people affected with liver diseases. As a green fodder, the sweet potato vines are greatly relished by pigs, by horses (although in moderation), by cows (whose flow of milk they greatly increase), and by sheep. The sheep-farmers of the West would provide their sheep with an excellent green fodder all the summer through by planting with the plough small tubers, or even roots, in their sandy (now nearly useless) patches. The *Batata* vines make also a good hay, but they are of no use for ensilage, the fermentation turning them into a kind of slimy, unpalatable substance.

Horses do not take very easily to the tubers, but once they have tasted them they will eat them greedily. They get fat on them and put on a nice shining coat. Sweet potatoes are unsurpassed for increasing the flow of milk in cows and for fattening bullocks. Fed to pigs, raw or boiled, they produce the finest of bacon. Even the eggs of the hens fed on sweet potatoes seem to have an especially delicate flavour imparted to them. As for man, they are a food nutritious and healthy in every possible form. Children not seldom eat them raw as in the old country they eat chestnuts, which last they greatly resemble in taste.

There is still another use of the sweet potato, of which the writer claims to be the discoverer. It is the best-known substitute for coffee-beans, if cut into small pieces about a quarter of an inch square, dried on trays in the sun, then roasted on fire like the ordinary coffee-beans.

It may be asked, Why should horse-manure and no other be used to make a hotbed? Because it is the manure of a herbivorous but non-ruminant animal. It appears to be richer in certain components than other manures, and has the remarkable property of being set into fermentation at any time by the use on it of the watering-can.

It may further be asked, What were the advantages of growing sweet potatoes *on the flat*, and not on *ridges*, as is done on the coast? The reason is that on the coast provision has to be made against excess of rain, whilst in the West every bit of moisture must be carefully husbanded. This is best secured by the flat system, there being no hilling necessary, except the little which is done naturally by the frequent use of the Planet junior.

Sweet potatoes in the West have brought as much as 18s. per bag, when early and of good quality, and seldom do they bring less than 2d. per lb.

At that time the same product from the east was being sold in town for 4s. and 5s. per bag. The sweet potato grown in the West is more mealy, keeps better and longer than that grown on the coast. This induces the belief that in years to come the West will get as great a name for its sweet potatoes as it has already got for its grapes.

One farmer declared that it could never pay because there was too much *bother* about it. But *bother* is the only thing which makes farming pay, whilst laziness, sluggishness, and carelessness will never make any crop pay.

Coffee-Growing at Cairns.

From the *Cairns Post* we reprint the following extracts from a private letter written by a well-known resident to a friend in England in reply to queries *re* coffee and sugar growing in the district:—" On the low-lying lands between the sea-coast and the foot of the Cairns ranges, the climate from about September to March is more or less damp and steamy, of course, perfectly suitable for tropical agriculture, such as sugar, which is fast becoming a very large industry. There is plenty of scope for sugar-planters; the soil is rich and well watered; rainfall very good; remaining months of the year are cool and pleasant. Ascending the range by railway, a sort of hilly tableland occurs, which extends inland, but which, for some miles around the vicinity of Kuranda and extending in each direction about parallel with the coast, is covered with dense tropical scrub. The soil is exceedingly rich in many places, and this portion of the tableland is from 1,100 to 1,600 feet above sea-level, and averages about six miles from the coast. This prevents frost in the cool months; and the sea breezes in the warm months, being above the influence of evaporation, are very cool and pleasant. The thermometer goes down to about 36 degrees in winter, and averages about 83 degrees in summer. Further inland again, at Atherton, about fifty miles from Cairns, lies an immense belt of agricultural country covered with very heavy scrub full of valuable timbers. The land about Atherton is about 2,500 feet above sea-level.

" Frosts occur in the cold months, and the climate, with the exception of about three months out of the year, is probably as near perfection as it is possible to be. The soil about Atherton is generally considered to be amongst the richest in Australia. The rainfall is also good. The average rainfall at Cairns and on the adjoining ranges is about 80 to 100 inches per annum, well distributed. It is generally considered that along the top of the range or tableland, where the soil is good and no frost occurs, is the best place for growing coffee. There is no doubt, as has been proved, that at any rate up to about six years the coffee-trees grow exceptionally well and bear heavily when properly planted, but a lot yet remains to be proved before the industry can be called a perfect success, although enough has been proved to warrant anyone going in for it with an exceptionally good chance of success. With regard to labour, there is a moderate supply of kanaka labour available, which is good labour. Wages are from £16 to £18 per annum and find them in food. Children (who pick well) are available to cope with it for some years to come. From the crops already picked, it is generally expected that, with 430 trees to the acre, about half a ton of dried beans to the acre may be relied on when the tree is five years old; the trees generally commence to bear when three years old, and the dried beans are worth about £90 per ton. The price of land is £4 per acre, varying in different localities. Anyone going in for coffee, by looking well around, might possibly pick up good bargains. The approximate cost of purchasing and preparing uncleared scrub land per acre for coffee would be about as follows:—

Purchase of land, say	£4
Clearing and burning off scrub	4
Grubbing up stumps	8
Digging holes for plants	5
Etc.	1
	£22

"To put, therefore, say 20 acres under coffee would cost approximately as follows:—

	£	s.	d.
Purchase of land, preparing same and planting coffee, 20 acres at £22 per acre	440	0	0
Fencing, say...	60	0	0
Dwelling-house, say...	150	0	0
Farming implements and horses, about	100	0	0
Cultivating plantation for, say, three years until trees bear, allow	150	0	0
Contingencies, allow	50	0	0
	£950	0	0

"Add to this the cost of living, say, for three years. When trees are three years old you could expect a small return, which would increase to full returns when the trees are five years old. Half a ton of dried beans would be worth £45, and the profit per acre could be estimated at £20, according to present prices, which are considered lasting. That is: By an expenditure of, say, £950, and cost of living for three years, you should expect a return from 20 acres of coffee of about £400 per annum in five years from sowing the seed; allow about profit of £200 the fourth year. I may mention also that there are many other things that can be grown with more or less profit besides coffee and sugar, such as oranges, lemons, limes, citrons, mangoes, cocoanuts, bananas, maize, rice, ginger, pineapples, and many other things. Going further inland, there are immense tracts of rich mineral and pastoral country, producing gold, copper, tin, and silver, and carrying thousands of cattle. For anyone with a moderate amount of capital, and a fair stock of health and energy, especially young fellows with the best part of their lives before them, I think there are few better places than this for them to make a start and expect a good return for their outlay.

"It must be noted that the above approximate estimate of outlay and profit refers to men who are not used to manual labour themselves, and would have to employ all the labour required. Of course, any man used to manual labour, or if married, or if he has children, could do, say with the help of a few kanakas, all the necessary work, and could put smaller areas under coffee at a much less outlay, and expect a larger profit per acre. This would apply in particular to married men with families."

The Dairying Industry in Queensland.

By JOHN MAHON,
Government Dairy Expert

In writing on this very important industry, reference must first be made to the marked success which has attended the first shipment of butter of any importance from this colony to the London market. The first experiment in the export trade about two and a-half years ago was brought about by a small consignment of 9 tons, which arrived at its destination in excellent condition. This year a larger shipment (over 63 tons) was sent away per s.s. "Jumna," and the reports on its quality on landing have given ample assurance that Queensland can hold its own in the world's market for dairy produce. This should be extremely encouraging to every person connected with dairy farming, and the marked success of both experiments must undoubtedly give a great impetus to the industry. No one could feel more pleased at the results than the writer, although it was no more than he anticipated. When doubt was expressed by some of those contributing to the shipment, that the Queensland butter would suffer in comparison with that exported from other colonies, they were assured that unless this colony had to compete against a better article than that made in the southern colonies, there was nothing to fear. In making the necessary arrangements for the last shipment, the Under Secretary for Agriculture gave a free hand in the matter, merely advising that special precaution be taken with regard to refrigerating space, and that the Government brand be placed upon nothing but an article of the best grade. In carrying out this duty it is but just to remark that special thanks are due to Messrs. E. Bland and J. E. Lerescbe, joint managers of the B.I.S.N. Company, for the completeness of the arrangements made for storing the butter on the voyage, a room being specially constructed for the purpose. Mr. McInduer, chief engineer, is also deserving of every praise for affording every facility to ensure success. The butter was packed with space between each layer of boxes, thus allowing a free circulation of air. This involved an extra amount of space and labour, which in future can be avoided by using the patent "glacier" butter-box. Had the butter been packed in the ordinary way, without an air-space between, the cold air would not have reached the boxes in the centre. At the writer's suggestion, with permission from the Under Secretary for Agriculture, samples of butter and cheese were procured, paid for by the Department, apart from the main consignment. These were given in charge of the chief engineer, who kindly consented to make experiments during the voyage, and the result of these has already been published. With regard to the temperature at which the butter should be carried, but one opinion was held by the writer—that is, that a temperature of as near 35 degrees Fahr. as possible should be maintained, and instructions to the chief engineer were given accordingly. The tendency towards freezing, as is the case with some shippers, is erroneous. Experience shows that freezing gives the article a tallowy appearance, destroys its texture and flavour, and impairs its keeping qualities. As a check against the temperature at which the butter would probably be kept during the voyage, a sample box from each consignment was placed in the railway refrigerating stores at Roma street, all of which when opened on the 17th May, about fifteen weeks subsequent to the departure of the "Jumna," were found to be in excellent condition. The importance of this practical test cannot be over-estimated, and to those concerned it will be gratifying to know that, though

starting late in the race, with a little perseverance Queensland may yet hold a prominent position in the London market. Another matter on which the farmers and dairymen of Queensland are to be congratulated is that a number of samples of farm and dairy produce were exhibited by the writer at a large influential gathering of merchants and experts in Victoria, all of whom pronounced them of excellent quality. The butter, after undergoing a severe test during the voyage, was stored for eight weeks in Melbourne, and when opened was found to be in excellent condition. The cheese was considered exceptionally good, in fact almost equal to the best brands of New Zealand. The samples of farm produce also were considered very good. Many of those present were astonished to find that such excellent products could be produced in a colony which was considered by a number of Victorians as only fit for cattle-raising and sheep-farming.

EXPORT TRADE.

Although the recent shipment of butter from Queensland has proved such a success, and to a certain extent has established a reputation in the London market, yet optimists must not be led away by the belief that the acme of perfection has been reached, or that there is nothing more to be done or learnt. It behoves manufacturers to avail themselves of every opportunity to improve their conditions and methods by putting into practice the scientific and practical knowledge to be obtained from the leading agricultural colleges of America and elsewhere. Science at present plays such an active part in the industry that to ignore it means not being in the race. Some manufacturers who consider themselves on the top step of the ladder of perfection are far from it, and would do well to pay a visit to neighbouring factories, when amongst other things likely to benefit them, they would obtain a knowledge of the different flavours of butter and cheese. The man who is accustomed to handle only the article of his own manufacture, often acquires a taste for that particular flavour, and is apt to consider it better than an article much superior. Others, again, are careless in preparing and churning their cream at the proper stage of ripeness—a most important matter. It also came under notice that amongst consignments shipped to London, in some cases, much neglect was displayed in the packing, handling, and branding of the boxes. These may seem trivial matters at this end, but they detract seriously from the appearance and price of the article when placed on the market. One great defect in the present system, and to which the writer would like to draw special attention, is the irregularity of our supplies. To retain a firm hold of the London market this must be altered, and can only be brought about by adopting a method whereby an equal number of cows are kept in milk during the year round, and by feeding during the winter months. This is the secret of the Danish people's success, and which has done more towards establishing their trade in the London market than their climate, and proximity to that market, than many in Australia are led to believe. Under the present system in Queensland, expensive plants are lying idle for half the year, employees must be paid, and proprietors, if not actually losing money, get but a poor return. Were these factories kept going all the year round, the cost of production would be reduced, and all concerned would profit to a greater extent. The improvements pointed out cannot naturally be brought about in a day, but it is hoped that a move in the direction suggested will ere long be taken.

THE DAIRYING INDUSTRY—PAST, PRESENT, AND FUTURE.

Until within the last five or six years the prevailing opinion was that Queensland would never be in a position to export dairy produce successfully, or compete against the southern colonies. Climatic influence was considered unfavourable, but the idea has exploded, and recent experiments have proved that Queensland dairymen are able to turn out an article equal to that produced where it was claimed that the surroundings were more favourable. At the time mentioned 75 per cent. of the dairy produce consumed in this

colony was imported, but now we can not only supply our own demand, but in the near future, if seasons are favourable and the present progressive spirit prevail, Queensland should be drawing large sums of money annually from England and elsewhere, which must undoubtedly tend towards the prosperity of those gaining their living from the land. About eight years ago, when the Travelling Dairy under the auspices of the Department of Agriculture was first instituted as a means of educating the farmers, the idea was severely criticised by many, but the fact remains that the results exceeded the most sanguine expectations. Factories and creameries have sprung up in nearly every district visited by the Dairy, and many of the managers of these, together with hundreds of farmers, are prepared to testify to the value of that institution. The Travelling Dairies not only turned out proficient factory managers, but imparted a practical knowledge to individual dairymen who were not in a position to join in the factory business, and enabled them to make a creditable article. In fact, it is fully admitted by all but those who are prejudiced that the Travelling Dairies amply justified the purpose for which they were intended. The vast improvement in the quality of our dairy produce, not only from factories but private dairies, as compared with that of some years ago, must be apparent to the most casual observer, and proves conclusively the rapid strides made during that short period. Many predict that the industry will be overdone by the production exceeding the demand, but such will assuredly not be the case, as the increasing demand will always keep pace with the increasing production. One great point in favour of the Queensland dairyman is that milk can be produced here at a less cost than in any other country in the world. The farmers have discovered that they must place at least a portion of their crops on the market in a more condensed form than was the case hitherto, such as in butter, bacon, cheese, &c. It is a well-known axiom that a succession of crops impoverishes the soil, and to avoid this a system of mixed farming should be adopted.

DAIRY CATTLE.

That the quality of his herd is an important factor in the dairyman's success goes without saying, and the present dairy herds in Queensland are in general, to say the least of them, an inferior lot. In building up a good herd, a good milking strain should be aimed at, regardless of breed. Good and bad milkers are to be found among all breeds. Very often the progeny from the best of milkers is destroyed in the rearing, for if the calf is stunted or badly cared for, the animal will never become such a good milker as if it had been treated properly. It is a mistake to think that a good herd can be got together under any other circumstances. One often hears the remark that the calf from a cow of exceptional quality turned out disappointingly, which in many cases is not to be wondered at when no attention has been paid to its rearing. Good breeds in the hands of the careless dairyman will quickly deteriorate. Care and feed are absolutely necessary to produce a good animal, but as the Americans say, "unless it be supplemented with knowledge in breeding, the transmission of that quality will be slow and attainments doubtful." Here is where the trouble lies: quality has been obtained in many individual cows of different breeds, but it has not attained regularity of power to transmit these same qualities to the offspring. An excellent guide in the selection of dairy cattle is to note how the good qualities are first developed. A well-known authority in America says the work begins by exciting the udder to unnatural activity by stripping it continuously of all the milk secreted. Such stripping is a call on Nature for more milk, which leads to a call for more blood, then more food to produce the blood, &c. This course persistently followed leads to the formation, on the part of Nature, of an animal which eats largely, digests, and assimilates well. In the case of a beast with a good constitution, additional force is expended in elaborating the milk from the large quantity of blood produced from the amount of food consumed. Seldom are two men to be found who agree as to what is the best breed for dairy purposes, many being

prejudiced against any breed but their own. While in Victoria a few weeks ago, the writer made particular inquiry as to the breeds most in favour there, and found 75 per cent. in favour of the Ayrshire and shorthorn cross. The champion cow of Victoria at present, "Daisy," is from a shorthorn cow by an Ayrshire bull. She was bred by Mr. John Grant, of Seafield, Victoria, and gave 107¾ lb. of milk in two days which produced 7 lb. 5½ oz. of butter, or 3 lb. 10·3 oz. per day. "Daisy" is a very plain-looking animal, and on her appearance alone, if offered in our auction yards, would sell for about 30s. It is not to be inferred from the foregoing instance that the Victorian dairy herds are perfect, far from it; but it must be admitted that in ninety cases out of 100 they are superior to Queensland herds. The Victorian dairymen have realised the necessity of producing milk at a less cost, and in consequence are endeavouring to improve their herds by procuring the best milking strains. Now that the College is established, an opportunity is afforded to show the dairymen the results obtained from the various breeds, and in the next issue of this journal a few points to be considered in selecting a milk-producing animal will be given.

TREATMENT OF MILK.

It is a pleasing fact, and one which should be appreciated by all who have the welfare of the dairying industry at heart, to learn that it is the intention of the Minister for Agriculture to bring before Parliament next session a Bill making the aeration of milk at the farms compulsory, and also to provide for strict supervision over the sources of milk supply. Under existing circumstances the production of a certain amount of inferior dairy produce cannot be avoided. One dairyman who disregards cleanliness, supplying milk to a factory is quite sufficient to destroy all his neighbours' milk and give the manufacturer no end of trouble. Legislation in the matter is, in the writer's opinion, a step in the right direction, and will enable those engaged in the business to manufacture an article superior to that made under present conditions. The expense incurred by the dairyman in aerating his milk and carrying out a system of cleanliness will be no greater, and his profits will increase, for if the factories are successful the suppliers must participate in the profits. Too much stress cannot be laid on the importance of the treatment of cattle and the careful handling of milk. Cattle that are badly treated cannot produce good milk, and from such milk good butter or cheese cannot be made, consequently the manufacturer is at the mercy of the milk suppliers. It must be borne in mind that no article of food is so absorbent or so susceptible to taints as milk, and unless strictly guarded against, impure bacteria will find their way there. The filthier the condition of the milk, the more favourable the home afforded to these impure germs. Millions of minute organisms are to be found in dirty yards and adhering to the cow's udder, which find their way into the milkpail, with the result that the milk is contaminated, and no longer fit to be converted into a good article. In making a series of experiments, Professor Russell found that when cows were milked in the stable, the average number of bacteria which fell per minute into a pail 10 inches in diameter was 5,300, and when the cow's udder and the hands of the milker were washed before milking the number was reduced to 1,300. When a similar experiment was made in the open air the diminution was 90 per cent. The same authority further states that when cows are fed in a stable with hay just before milking the air is densely charged with dust and spores of bacteria. Under such conditions we are assured that over 160,000 micro-organisms fall into the milkpail per minute, against 2,400 when a thorough system of cleanliness was adhered to. Most people are now aware of the fact that milk contains pure and impure bacteria, and under ordinary circumstances the multiplication of these is so great that it remains to be determined what part they play towards assisting the manufacturer, or otherwise. The most eminent authorities of the present day tell us that the bacteria found in milk can be classed under two groups.

As there are various forms of animal life found only in certain regions and climates, so also are there bacteria, which have become so accustomed to live in milk that they are in some form or other frequently met with in all dairy products. Those of a friendly nature are of the most interest to dairymen, and are the cause of most of the alterations in milk. Then there are others which are termed accidental guests, taking their origin from filth in some shape or other, thus finding their way into the milk, and once there, they multiply rapidly, and often introduce substances of a poisonous nature. In America cases have been known where cream, cheese, milk, &c., have been the cause of poisoning those who partook of them. These germs are termed pathogenic, and from their morbid nature are often the means of spreading diseases. Such profound scientists as Pasteur, Fleischmann, Lazrus, Duclaux, and Bilter have proved beyond a doubt that these pathogenic germs are destroyed by pasteurisation. Bilter, by experiments, has proved conclusively that heating milk for 15 minutes to 154 degrees to 156 degrees Fahr kills the typhus bacillus with certainty. Cholera and diphtheria bacilli are less heat-resistant than those of either tuberculosis or typhus, so it follows that they too would be destroyed by this treatment. As already pointed out, these diseased germs find their way into the milk from filth or carelessness on the part of the producer before it leaves the farm. In concluding these remarks it may be said that while the person in charge of the creamery receives milk containing dead flies, cow-hair, &c., it cannot be expected that Queensland dairy produce can be brought to the required pitch of excellence.

BUTTER-MAKING.

In Queensland, as in the southern colonies, sufficient care is not being exercised in preparing and ripening the cream for churning, with the result that there are bound to be various grades of butter in each shipment and from each individual factory. To overcome this serious trouble a "starter" (a pure culture of bacteria) must be added to ripen the cream. By doing so the factories will be enabled to turn out a uniform grade of butter, free from "fishiness," so much complained of in the English market. Fishiness in butter is due to no other cause than badly ripened cream. Cream should not be kept too long before churning. A sufficient quantity of ferment (not more than 5 per cent.) should be added to bring the cream to the proper stage of ripeness within twenty hours. Nearly every competent factory manager is or should be aware of the fact that cream kept over for forty-eight to fifty hours becomes stale, and is no longer in a fit stage to be converted into a nice, well-flavoured butter. Instructions for propagating and using the ferment can be found in dairy pamphlet No. 9, issued by the Department of Agriculture in February, 1896. Butter-milk from the previous day was universally used as a "starter," which method is still adhered to in many places, and is not objectionable, provided the butter-milk contains pure lactic ferment, which is capable of producing a rapid development of the lactic acid. As soon, however, as other ferments crowd out the lactic ferment in the butter-milk, which may easily occur in the hot weather, the cream becomes seriously affected. Too much attention cannot be paid to the proper ripening of cream; and however much some of our factory managers may be prejudiced against departing from the old groove, I would certainly advise their adopting the use of a ferment in ripening the cream. In the last shipment of butter from here the writer observed a great want of uniformity in salting, which is due to the same amount of salt being used on a moist butter as that on a dry, and therefore would advise a little more discretion being used in this respect. Every manufacturer knows that if the butter contains excessive moisture more salt should be used, as a great deal of it is carried away in the moisture during the working. A well-made butter should contain about 13 per cent. of moisture, water itself greatly helping decomposition.

CHEESE-MAKING.

Queensland cheese-makers are to be congratulated on having brought the quality to such a high pitch of excellence. The quality is certainly equal to that of some of the best New Zealand factories, and now that an Act of Parliament is likely to be passed making the aeration of milk at the farm compulsory, the quality will reach a higher standard. This industry will most certainly assume very large proportions in the near future. At the same time it must not be forgotten that the matter is in the hands of the farmers themselves, and unless they adopt a better system generally, in the way of improving their herds and paying more attention in the matter of feeding during a time of need, their profits will not be so great as they otherwise would be.

(To be continued.)


DEPARTMENT OF AGRICULTURE
QUEENSLAND

Fruit Culture in Queensland.

By ALBERT H. BENSON,
Government Fruit Expert.

THE subject to be dealt with under the above title is a somewhat comprehensive one; more comprehensive than most persons imagine, as it embraces the cultivation of practically every fruit of commercial value that can be grown in any part of the world—extreme tropical fruits such as the Durien and Mangostan probably excepted. Few persons realise the magnitude of this colony, or have any idea of the wide range of climate to be met with within its boundaries: climates varying from that of the temperate regions, as at Stanthorpe, to that of the tropics, as at Cairns or Cooktown, with any other kind of climate that can occur within these extremes; climates having a heavy rainfall and a moisture-laden atmosphere to climates with a small and very uncertain rainfall and a dry atmosphere, and climates that come in anywhere between these. This variation of the climate, or, rather, this large number of climates, accounts for the comprehensive nature of fruit culture in Queensland. In the temperate districts all the fruits of the temperate regions can be grown; in the semi-tropical districts, those of the semi-tropics; and in the tropical districts, those of the tropics; and, in addition, we have the medium climate of the tablelands, capable of growing good deciduous fruits, table and wine grapes, and the dry, hot climate of the interior, which, when the rainfall can be supplemented by irrigation from artesian or other sources, will grow fruits that are valuable for drying, oil-making, raisins, wine, or brandy.

When planted in suitable soils and favourable situations, fruit trees of all kinds make a very rapid growth, and attain an early maturity—citrus trees occasionally fruiting in four years from the planting of the seed, and olives in four years from the planting of the truncheon, a rapidity of growth that will hardly be credited by European growers.

Many parts of the colony are so well adapted for fruit culture that several varieties of fruits grow well and produce heavy crops, even though the land is entirely uncultivated and the trees are neglected and uncared for. It is not at all uncommon to come across fruit trees, such as oranges, common lemons, citrons, mangoes, guavas, peaches, &c., in a practically wild state, apparently thriving as well as any of the indigenous trees or plants growing beside them. The ease with which many fruits can be grown, though showing the suitability of the soil and climate for their growth, has not been altogether an advantage, as it has been somewhat of an incentive to carelessness on the part of the fruit-growers, and has resulted in the chance production of a quantity of worthless fruits, which only become a breeding-ground of disease, and consequently a source of trouble to the district in which they are growing. On the other hand, when we find that fruit trees do so well, even when neglected and uncared for, it demonstrates the great possibilities there are for fruit-growing, when carried out on a thoroughly systematic and business basis. In a climate like that of Queensland, especially in the warmer and more tropical parts, fruit is an absolute necessity as an article of diet, in order to keep up the health and vigour of our race. For hot climates, fruit is Nature's food and Nature's medicine, and as long as it is fresh, good and properly ripe, it is highly nutritious and very wholesome. Fruit should be used by every family in the colony at least once a day, and in the warmer parts it should form a portion of every meal. It should be looked upon as a necessity and not as a luxury, and it should be the aim of every fruit-grower to grow good fruit, and to assist in its distribution in such a manner that the consumer may obtain it in good order and at a reasonable rate This will increase the consumption, and consequently benefit both the producer and the consumer.

In this my initial paper on Fruit Culture in Queensland, I wish to point out to all those who are interested in this subject that the object I have in view is twofold, as in the first place I hope to give fruit-growers and all those who intend to go in for fruit culture, information connected with every branch of the fruit industry that there is any chance of carrying out successfully in Queensland; and, in the second place, that this paper shall be the first of a series of articles which may eventually form the basis of a text-book on Fruit Culture for Queensland.

In order to carry out these ideas, it is necessary to start from the beginning; but before dealing with my subject proper I think it will not be out of place if I give a few words of advice and warning to intending fruit-growers, as a little timely advice may be of value to them and save many a failure: "Don't run away with the idea that growing fruit consists mainly in sticking fruit trees of various kinds into the ground and then waiting till the fruit (if any) is ready for gathering, or that it is only of secondary consideration—a business that can be tacked on to general farming, dairying, poultry-raising, or market-gardening; in fact, that it is of little importance, and that it can therefore be left largely to take care of itself. If you have these notions, the sooner you get rid of them the better, as fruit culture under such conditions (and I am sorry to say that these conditions are of very common occurrence) will not be a success. Anyone who thinks that fruit can be grown successfully in such a manner, had better give up all thoughts of becoming a fruit-grower and take up some easier occupation, as fruit culture has now become a science, and the man who wishes to succeed must carry out his work on scientific lines and use his brains as well as his hands. No branch of agronomy requires more careful study than that of fruit culture, and none pays better for extra care and attention to details, as what with the vast army of pests of all kinds that fruit-growers have now to contend against, and the comparatively low prices realised for their produce, which is largely owing to the very imperfect manner in which fruit is distributed or disposed of, it takes a man who knows his business thoroughly, and who conducts it on proper business lines to make a successful fruit-grower. The old slipshod, happy-go-lucky methods of fruit culture are or should be things of the past, as the only way in which we can make fruit-growing a success in Queensland is to carry it out on the most approved lines and on a sound business basis, and the sooner we realise this the better for the fruit-growing industry of this colony."

Having now shown briefly—1. The very wide range of ground that must be gone over in dealing with such a comprehensive subject as fruit culture in Queensland; 2. The adaptability of a large portion of this colony for fruit culture; 3. The reasons why we should grow and why we should use fruit; 4. The manner in which fruit should be grown, and the manner in which it should *not* be grown; and, lastly, the objects of this paper generally—I will now go on to the subject proper, and start with a description of the soils that are suitable for fruit culture in Queensland.

FRUIT SOILS.

Though fruit can be grown in nearly any kind of soil if given the necessary attention, yet there are certain soils that are much better adapted for fruit culture, or for the growth of special fruits, than others. This being so, it is of the first importance to select a suitable soil for the individual fruit or fruits that one wishes to grow. There are several types of soil suitable for fruit culture, but it is essential that they be all alike in one respect; and that is, that they possess good natural drainage, so that there is no possibility of stagnant water lying round the roots of the trees. This question of well-drained soils is of vital importance for fruit-growing in this colony, as, owing to the fact that the latter is subject periodically to very heavy rains in many parts, unless there is a ready escape for the surplus water, the fine fibrous roots of most fruit trees will be scalded, and the trees will be seriously injured, if not killed outright.

Probably the best all-round fruit soils are deep sandy loams, light loams, or loams of medium texture; heavy or clay loams are not, as a rule, suitable. Such soils may be of any colour except pale-yellow or white, which are usually sour and very poor; but grey, reddish, light-brown chocolate, or blackish (if not swampy) soils are all good if deep enough, and if they possess porous subsoils that will not retain stagnant water. Such soils are usually alluvial, or formed by the disintegration of the rocks of one or other of the Sandstone Formations. They are easy to work—retain moisture well when cultivated—trees root well in them; and though in many cases they are not of great natural fertility, still when of good depths there is such a large area for the roots to derive their plant food from, that they are not easily exhausted, even when the trees, or rather the roots of the trees, occupy the whole of the ground. Another point in favour of such soils is the readiness with which they respond to the application of manures, should the trees be showing the want of plant food. Soils of this character are to be met with in most parts of the colony—sometimes in large areas, and sometimes in patches extending in area from a narrow strip along the banks of creeks to small patches of a few acres in extent, and to, in some cases, large areas containing many square miles of country. Land of this character is sometimes covered with scrub and sometimes with forest, usually more or less heavy in the coastal districts; but in the interior it is usually pine, belar, or light box—country usually easy to clear. The timber growing on the land is, as a general rule, a very good indication of the suitability of the soil for fruit culture, and should be carefully noted when selecting the site for an orchard. Land covered with tea-tree, honeysuckle, bloodwood, mahogany, stringy-bark, or with many stunted flowering shrubs of various kinds is, as a rule, a bad fruit soil, as, though often of a sandy loamy nature, it is usually poor, sour, and badly drained, often spuey, with yellowish or whitish clayey subsoil.

Good medium light or sandy loams form the best of soils for the following fruits:—Citrus of all kinds, peaches, Japanese plums, persimmons, figs, grapes, many kinds of olives, apples, almonds, custard apples, mangoes, pineapples, walnuts, and chestnuts. Fruits such as pears, apricots, cherries, plums, or prunes will grow well in such soils; but will produce fruit of finer texture and superior flavour when grown in richer and heavier soils.

Sandy loamy soils of depths varying from 10 to 30 feet are met with in many parts of the colony; and such are the best fruit soils for standing the extremes of the Queensland climate, as they will stand any quantity of rain without injury, and, again, they will resist long periods of drought, owing to their power to retain moisture when kept in a thorough state of cultivation. Trees planted in such soils root deeply, and are not greatly affected by the drying out of the purely surface soil, as would be the case were the soil at all shallow. Again, the fact of fruit trees rooting deeply in such soils allows of thorough cultivation to a depth of six inches or more without any fear of injuring the roots, and the deeper and more thorough the cultivation, the longer the soil will retain moisture during a dry spell. Where such soils are rich in decayed leaf mould or other organic matter, bananas do well, if the district has a heavy rainfall and is free from frost; but, unless heavily manured, bananas will rapidly impoverish them, and they will, therefore, only stand a few years' cropping. In addition to sandy or light loams, medium loams of volcanic origin, especially if rich in organic matter, make the best of fruit soils. Such soils are usually covered with scrub, and are very fertile—fruit trees of all kinds making very heavy growth. Thorough sub-drainage is essential to such soils, and where this exists there is probably no better soil for bananas, pineapples, or any tropical or sub-tropical fruit, excepting the lemon, which grows far too rank and coarse in such soils, and the orange even is apt to be coarse till the trees attain some age. Similar soils, when occurring in colder and drier districts, are adapted for the growth of pears, olives, plums, prunes, apricots, and cherries in the coldest parts, and grapes for table use or for raisin-making, but not so good for wine, though, when such soils are rich in lime, they will probably produce a good brandy.

Heavy volcanic soils, whether red, black, or chocolate, though of extreme fertility, are not as a rule good fruit soils, as in the first place they are often too retentive of moisture—cost too much to cultivate, and if not cultivated, dry out and crack badly during dry weather. Where the climate is suitable, pears, apricots, plums, and prunes are the best fruits to grow on such soils; and when they occur in the tropical parts, bananas will probably do best. In a colony like this, where there are millions of acres of land suitable for growing the various kinds of fruit, I strongly advise that the cultivation of fruit for commercial purposes should be confined to such soils as I have described, for the only case in which it is permissible to use unsuitable soil is where the grower has only a small area of land, and has therefore no choice; and then it is not advisable to grow more fruit than is required for home consumption, as it cannot be grown at a price that will enable it to compete with fruit grown elsewhere under more favourable conditions.

When it is desirable to grow fruit in such soils, then it will always pay to give the land extra preparation either by trenching or sub-soiling combined with sub-draining; and by this means even poor clayey, shaley, or gravelly soils can be made to grow good fruit. The question of the best methods of treating such soils will be dealt with further on, and in the meantime we will take up the question of orchard sites.

ORCHARD SITES.

In dealing with the question of orchard sites, one important consideration is that of locality, as the most suitable site in one district is not always the most suitable site in another, so that, as we have to take locality into consideration, it may be as well to point out what constitutes the most suitable locality before dealing with the question of site. In the first place it is useless to grow fresh fruits commercially in districts that are difficult of access and are far removed from rail or water carriage, as the expense of getting the fruits to market and the knocking about that they receive in transit, prevents any chance of profitable culture. Therefore no matter how suitable the soil or climate of such a district, it should be let alone till there are better means of communication. The most favourable localities are those that have good roads within easy reach of rail or water carriage, and which, when soft fruits are to be grown, should be within easy reach of a populous centre. Firmer fruits, such as apples, pears, oranges, pineapples, mangoes, and bananas, which may be kept for some time after they are gathered, may be carried much longer distances, but even these fruits will not pay if grown too far from a shipping point. Fruits that are grown for drying, however, will pay to grow even at considerable distances from a shipping point, as the bulk to be handled bears the proportion of about one-fifth to one-sixth on an average, to the weight of fresh fruit, and it is not injured by delay in marketing or by rough cartage. In growing drying fruits, the main considerations are suitable soil and suitable climate. The influence of locality on site may be best exemplified as follows:— On the coast it is advisable to protect orchards from south-easterly gales, and on the Downs to protect them from strong westerly winds, hence the lay of the land and the natural shelter should be chosen so as to form the best protection in each case. In selecting the site for an orchard the first consideration is, that the soil be suitable for the fruits that it is desired to grow, as no matter how suitable it may be in other respects, if the soil is bad the orchardist is heavily handicapped from the start. The second consideration is that of aspect or exposure, which should be *towards* and not *from* the sun, a north-easterly aspect being the best. The third consideration is that of shelter, as a good shelter on the side from which the prevailing winds come, or from which heavy storms may be expected, is of very great help to the orchard. The land should not have too steep a slope, as if so it is apt to wash badly during heavy rains; a gentle slope is, however, considered an advantage, though if the soil is

all right and has a thorough sub-drainage, it cannot well be too level, as the more level the land, the easier it is to cultivate, and the better the work that is done by the improved implements used for orchard cultivation.

SHELTER.

The question of shelter is one that is often overlooked by fruit-growers, and yet it is one that has a very considerable influence on the productions of the orchard. Absence of shelter means injury and loss from heavy winds, or from hot winds, and in many districts injury from frost, so that it will pay any grower, when selecting the site of his orchard, to take advantage of any natural shelter that may exist. Such shelter may consist of belts of native timber, belts of scrub, or a background of higher land. Where belts of timber exist, they should be allowed to remain standing on all sides from which damage is likely to come, leaving a good substantial belt and not a mere fringe of trees; and where a belt of scrub is left, it should be of a sufficient width for the wind not to blow through it, otherwise it will soon die out. Where there is no available natural shelter, then it is advisable to provide an artificial one, which should consist of a belt of trees, preferably evergreen, that are adapted to the soil and district; and in the case of open plain country these belts should be of forest trees and of sufficient width to be a thorough windbreak; two or three rows of trees, though of some use, being of comparatively little value when compared with belts two or three chains in width. Such belts of forest trees would, in addition to their value as windbreaks, become eventually of considerable value for their timber, for it is only a question of time when good timber will become a very scarce commodity in many parts of the colony.

(To be continued.)

Entomology.

DESTRUCTIVE INSECTS LIABLE OF INTRODUCTION TO QUEENSLAND.

By HENRY TRYON,
Entomologist.

In studying the animal life occurring in any district or locality, one is led to conclude that it may be grouped in two categories, one of which comprises forms indigenous thereto, and the other such as are of exotic origin. Now, with regard to the latter the derivation of its members from regions in which they are either indigenous, or have previously arrived, is usually accounted for by reference to the absence of natural checks—such as mountain chains, water expanses, climatic extremes, &c.; to spontaneous dissemination; to the simultaneous predominance of those conditions of environment that are favourable to distribution—afforded by suitable land connections, the persistence of aerial or ocean currents of definite trend, &c., the extension of congenial meteorological conditions, the fact that special food requirements are forthcoming in the prospective land of adoption, and, in the case of parasitic or commensal animals, the antecedent existence of suitable hosts. These factors have no doubt exercised great influence in determining both the extent and character of the immigrant forms of animal life in any region, already prior to the portion of mankind dwelling thereon having had any intercourse with outside peoples, and no doubt still operate to some extent in the same direction; but the changes that they induce in local faunæ are but gradually effected. It seems that they are, however, too exclusively regarded by students concerned with the problems of geographical distribution. For one cannot afford to lose sight of the fact that it is to human intervention, to international commerce, and to ordinary trade relations, operating it is true, in conjunction with such congenial natural conditions as are above alluded to, that a country is indebted for many of the forms of life that are most conspicuous in their presence. This is especially so as regards insects, and above all, of such as are injuriously related to the plants engaging the skill of either agriculturist or horticulturist, and which not only impair—or even determine—the vitality of these plants, but are also harmful to the crops that they yield or to the manufactured products that in these originate. This is the explanation of the fact that many species of insects included in the above definition that a few years since were either unknown, or if known had but a limited range of occurrence, are now regarded as being cosmopolitan in their distribution.

But this explanation of the progressive range of occurrence of pernicious insects does not apply to their foes. Insects in their native home are almost without exception to a large extent held in check by natural enemies—such as insectivorous birds, predaceous or parasitic members of their class, fungus organisms, bacteria, and the diseases occasioned by the presence of these living agents. But when such insects have but recently found their way or have been transported to new countries, it is seldom indeed that they are so victimised, and as a rule only so after a considerable period of time has elapsed since their first introduction, and thus they are for a long time more noticeable

for their depredations than are purely native or indigenous species. It is for this reason the introduced insects naturally engage such paramount attention when the pests of vegetation of any country or district come to be coped with, or even considered as a preliminary to that act.

A mere list of the destructive insects for which we are indebted to our commercial relations with other countries, or which other countries may similarly place to our credit, to which has been appended some indication of the manner in which the insects specified comport themselves in the countries of their birth and of their adoption respectively, would serve to fully substantiate these propositions. It is not, however, the purpose of this communication to enter into this phase of the subject, but rather to point out the manner in which injurious insects are wont to find their way hither, and also to indicate some kinds not already occurring in the colony that we may expect to receive.

Pernicious insects such as are alluded to may be distributed into two classes, the first of which comprises those that are injurious to animals, whilst the second embraces those harmful to plants. Each of these groups may, again, be subdivided into—(1) pests that determine chemical and other transformations in living organisms; (2) pests that limit the vitality of, or even kill such organisms; and (3) pests that consume or damage stored products, whether manufactured or not.*

From this consideration, relating to the comprehensive nature of the term "destructive insect," it must be abundantly evident that the subject to be dealt with, as defined in the title of this paper, is a very extensive one. Recognising this, attention is henceforth almost exclusively restricted to those forms of animal life that are injuriously related to cultivated plants yielding marketable products, and whether harmful to the plants as a whole that they attack or exclusively so to their fruit.

As to the probability of our receiving destructive insects from sources beyond the limits of the colony, it may be stated, as the outcome of a review of the plant pests already operating in Queensland, that with the exception of the common Fruit-Fly, cane grubs (Scarabæidæ), and a few other insects, it is almost entirely beholden to foreign lands for their presence. This fact it is proposed to further enlarge upon on some future occasion. And, moreover, there are a large number of varieties of destructive insects, many of them allied to those already introduced into the colony and for which similar favourable conditions for importation and for naturalisation are forthcoming, but which have not yet reached our shores and become established here, or which, if they have already done so, have not been remarked.

With regard to the circumstances that mainly contribute to their introduction, it may be stated that these consist in the unrestricted importation of merchandise yielding them food or shelter, or the latter only, from countries in which they already exist. That traffic in injurious insects is attendant on this form of commercial enterprise will appear from the following incident:—In the State of California, U.S.A., there is a statute creating a State Board of Horticulture, and amongst the regulations framed in accordance with the provisions of that Act are ones that empower that body to either absolutely stay the introduction of insect-infested plants or portions thereof, or to permit it only after certain measures of disinfection have been effectually carried out. These restrictive measures are enforced through the agency of a quarantine officer and entomologist in the person of Alexander Craw, whose special attainments are of the highest order. The report of that officer for the period intervening between 2nd July, 1894, and 29th August, 1895, on "Inspection of

* These groups, it must be remembered, are, however, not altogether mutually exclusive, thus certain insects—*e.g.*, water beetles belonging to the family Hydrophilidæ—consume both living animal and vegetable organisms, deriving their subsistence from the former when in the larva condition, and from the latter when adult; but more remarkable still, there are insects that are, when adult, indifferently animal and vegetable feeders, an instance of which has lately been brought to light through the researches of F. H. Chittenden, of the United States Department of Agriculture, relating to the habits of a dermestid beetle, belonging to the genus Attagenus, and which is exemplified in more than one family of Hymenoptera.

steamers, &c.," contains a list that "comprises the number of plants, trees, &c. (and disposition made of same) inspected," and from this it may be learnt that 232 ships arrived at the State with this class of merchandise aboard, each as a rule conveying but small parcels thereof. In the case of these vessels, on 119 occasions the plants, &c., that they contained were found to be "clean," whereas those carried in the remaining 113 had to be wholly or in part destroyed by reason of the presence of injurious insects upon them, or in those cases in which they were admitted—which was quite exceptional—had to be disinfected by dipping, fumigation, or other process. Amongst those consignments were two parcels of Australian apples, one comprising 326 boxes that was admitted after the fruit in question had been suitably fumigated, and the other 100 boxes that were sent back owing to default of the owner to submit them to this process. The plants brought in the abovementioned 113 vessels harboured no less than *forty-three* different kinds of destructive insects. "Should they (the report states) become established in our State, no one can foretell the misfortune that would be sure to follow." In Western Australia, again, similar events have transpired in the course of the administration of the "Destructive Insects' and Substances Act."

The precise vehicles for the introduction of insect pests are both numerous and varied. Living plants are noteworthy in this connection, and not only since they yield congenial conditions for the continuous subsistence and growth of the insects that are originally upon them, but because as a rule they are transported from the post or place of debarkation to the orchard or garden where they are to be grown with such dispatch that the chances of the natural death of the insects during transit are lessened to a greater extent than would otherwise happen. As will often happen, again, an introduced insect that will manifest its presence in the destruction of a particular kind of tree or growing crop, will arrive upon a plant entirely different in its nature from that which in either of these cases it acquires a taste for. Thus an insect harmful to a fruit-tree may be brought here upon a purely ornamental shrub—rose-trees being especially noticeable in this connection—or, as often happens, upon a fern of one kind or another. Nor is it essential in the case of every insect that the plant being imported, and on which it is borne, should be intact and provided with roots. Serious pests may arrive in a choice bouquet of flowers, and especially upon plant-cuttings. The contents of small packages that enter through the post office may serve also in this capacity equally with the bulky consignments that swell the contents of ships' holds.

Not only may the plant itself bring destructive insects upon it, but the latter may occur in or upon the fruit that it may have yielded and is the exclusive object of commerce. This source of danger is especially to be anticipated in the case of certain scale insects, for these, though imperceptible, it may be, to the unassisted vision when this fruit is dispatched by the consignors, and therefore overlooked, may develop their full proportions during the course of a long voyage, to which they may be subjected, and so on their arrival be already conspicuous objects. Fruits that themselves afford special places of concealment, such as, for example, the eye in the case of the apple, pear, and quince, may, though apparently "clean," on being disembarked harbour destructive insects in connection with them, especially plant-lice, young scale insects, and mites. Fruit, again, that reaches its destination in a rotten or semi-rotten condition should always be regarded with suspicion, as its decay may have been occasioned by the maggot of some fruit fly or by the caterpillar of some tunnelling insect, that may still occur within or adjacent to it.

Vegetables, again, form a highly suitable material for the introduction of insect enemies, even when they form the kitchen refuse, rejected in port from day to day by the cook of some oversea vessel. Doubtless the majority of our cabbage pests—*e.g.*, Diamond Moth and Aphis—have thus originated here.

Boxes, crates, bales, sacks, or the material that may compose the same or other packages will doubtless, as in the past, serve as the means for introducing injurious insects, especially in their egg or chrysalis state, as many of

these are wont, when about to undergo their metamorphoses, to leave the objects that have hitherto afforded them the means of subsistence. Familiar instances of the truth of this are afforded by the codlin moth, the caterpillar of which will spin up in a fold or even on the smooth and uninterrupted surface of brown paper that has contained infested fruit; and so, by reason of the material used in the construction of the cocoon, escape ordinary scrutiny. Bags that have recently held potatoes infested by the *Lita solanella* may, when transported from one place to another, even as the receptacles of other merchandise, serve as the means of disseminating an insect destructive alike to the tobacco plant as well as that which has formerly nourished it, in every stage of their existence.

Soil surrounding the roots of growing plants is again a fruitful source for the introduction of pests. In this way, as in the past, we may expect to receive the eggs and young of both slugs and snails; the larvæ of scarabæids or chafers, as well as of Eumolpidæ, Galerucidæ, and other families of beetles destructive in both grub and perfect conditions. Certain kinds of Coccidæ, or scale insects, may again find their way hither in this way, especially those belonging to the genus Dactylopius, or mealy bug, which frequently attached to roots oviposit in the soil, with the result that their minute young occupy the interstices of this as well as of whatever box or other receptacle that may contain it. Again, in the soil itself may be introduced various aphides, as also nematodes or gall worms.

That which has been stated with regard to fruit also applies to other vegetable products—*e.g.*, tubers, seeds, &c.; even when these be imported without the definite intention of being used for cropping the soil. This contention receives support from what has been experienced in the case of such introduced pests as the potato tuber-worm, or the Bruchidæ—the weevils of pulse; the latter, it is hoped however, not yet naturalised in our cow-pea cultivations. Grain, if already not properly cleaned on arrival, may contain the chrysalises—the so-called "flax-seeds"—of the Hessian Fly.

More than one class of the goods that form part of a grocer's stock in trade may act as the vehicle for the introduction of baneful forms of insect life. These, it is true, are usually assignable to the group defined as domestic pests, since they in great measure restrict their attention to manufactured articles and other commodities affording us raiment or shelter; yet there are no grounds for concluding that with the lesser wax moth of the beehives, that—as has been pointed out by a local resident, H. Hockings—finds its way hither on dried fruit, we have received the last of the pests that travel further afield.

Straw-packing, including hay formed of the stems of timothy, &c., may be expected to serve as the means for the introduction of one or more of the straw-mining insects injurious to cereals—*e.g.*, the Hessian Fly and Joint Worm (*Isosoma*): a remark that especially applies to that covering agricultural implements, since these may be taken, with the packing still attached, direct from the place of debarkation to agricultural holdings where wheat, &c., is being grown.

Yet there are still other ways in which agronomic pests such as are alluded to may gain entrance and establishment here. One of these consists in the importation of insects—*e.g.*, silkworms—yielding or supposed to yield valuable products, and the subsequent liberation of these, either accidentally or intentionally, and in the latter case even regardless, it may be, of all consequences. An instance of this is afforded by what has been experienced in Massachusetts, U.S.A., with respect to the gipsy moth *(Ocneria dispar)* introduced there from Europe as a possible new source for silk by a private enthusiast, whose enterprise has already occasioned an outlay on the part of that State of many thousand pounds sterling.

PROBABLE IMPORTATIONS.

Amongst deleterious insects that it is anticipated will find their way into the colony, the following may be specified in connection with the particular plants they affect. Many plant-enemies have already been introduced from outside, and have become established in our cultivations; and the number of probable new importations will therefore appear small to those who are not apprised of this fact. In some few cases the names of insects already met with here are included, insomuch as their range of occurrence in the colony is quite limited. Such names are distinguished by an asterisk.

INSECTS INJURING PIP-FRUIT TREES.

APPLE.

Codlin Moth (*Carpocapsa pomonella*). In apples, quinces, or pears, or in packages or cases that have contained this fruit. From any of the Australian colonies with the exception of Western Australia, from Europe, and from North America.

False Codlin Moths (*Cacœcia responsoria* and *C. postvittana*). In apples, or in packages or cases that have contained this fruit. These insects injure apples as does the codlin moth. The former of them has been thus referred to: "A pest of the very worst kind, and in many cases its ravages have been of a most serious nature" (C. French). Its arrival may be anticipated from Victoria, whereas *C. postvittana* may arrive from New South Wales.*

Apple-blossom Curculio (*Anthonomus pomorum*, L.). A small weevil, about ¼-inch in length, that undergoes its transformation within the flower-bud. In boxes containing earth and vegetable *débris* that have been derived from orchards infested with this insect. From European countries, including Mediterranean provinces. Introduction not highly probable.

Apple Weevil (*Rhynchites baccus*, L.). A purplish-red beetle with metallic reflections, having a body less than ¼-inch in length. Feeding whilst in the grub condition upon the pulp and ovary of the young fruit (Lunardoni, A.). Injuring pear also. Introduction possible, and in a manner mentioned under *Anthonomus pomorum*. From Europe.

Mussel Scale (*Mytilaspis pomorum*). Especially injurious to the apple, accounted to be in Tasmania even more deleterious than is the codlin moth. On apples, also on apple-trees, or on scions or buds thereof, or on various other plants, *e.g.* Frequently brought here already on fruit from southern colonies, but not yet established in the colony; from other Australian colonies, from Europe, and from America.

*Oleander Round Scale (*Aspidiotus camelliæ*). This scale insect was found on the Sandwich Islands "upon imported apple, pear, and peach trees in such numbers that some of the trees had died." (A. Koebele.)

Pernicious or San José Scale Insect (*Aspidiotus perniciosus*). Attacking apple, pear, quince, peach, apricot, and other deciduous trees. One of the worst scale insects known. On nursery stock, scions, or buds, or even on fruit. From N. S. Wales, Victoria, or California. Its occurrence has been noticed by the writer in five Queensland orchards; in four of them it is already stamped out.

Apple Web Moth (*Hyponomeuta matinella*, Zeller). Feeds gregariously on leaves and flower-buds of apple. The damage occasioned by this pest in France in some years amounted to a million of francs (Girard, A.). On young apple-trees in the egg condition during certain months. From European countries, including those bordering the Mediterranean.

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*An insect congeneric with these has been met with by the writer in the Stanthorpe district, but in its case the caterpillar fed exclusively upon the young foliage.

PEAR.

Codlin Moth (*Carpocapsa pomonella, vid.* "Apple").

Pernicious or St. José Scale (*Aspidiotus perniciosus, vid.* "Apple").

Leaf Slug (*Eriocampa cerasi*, Peck). The larva of a small 4-winged fly that is slug-like in appearance, and that adheres to the upper surface of the leaf whilst it devours the spongy tissue thereof. Also attacks both pear and plum in a similar manner. Very injurious at times, quite defoliating the trees. Already introduced to some of the other colonies.* On pear, quince, cherry, or plum nursery stock and in earth in which same are packed, since larvæ hibernate in soil. From the southern colonies including New Zealand; also from Europe and North America.

Pear Midge (*Diplosis pyrivora*, Riley). This insect resembles in appearance the Hessian Fly, lays its eggs in the flower-bud, and the resulting maggots find their way to the centre of the newly-set fruit, that becomes deformed and is retarded in its development. In soil in which midge-infested pears have been growing, and used for protecting roots of nursery stock. From United States of America. Introduction not very probable.

Pear-tree Psylla (*Psylla pyricola*). A small 4-winged sucking insect, occurring often very numerously on foliage of tree, covering same with honey-dew, the presence of which results in a general black discolouration. Also occurs on apple. In cases or on nursery stock, especially apple or pear, in or on which perfect insect is hibernating. Formerly introduced from Europe to the United States of America; may come, therefore, from either of these regions, but not very likely to arrive here.

QUINCE.

Leaf Slug (*Eriocampa cerasi*, Peck, *vid.* "Pear").

Pernicious or St. José Scale (*Aspidiotus perniciosus*).

Quince Scale (*Aspidiotus cydoniæ*, Comstock, *vid.* "Apple"). On garden plants and on nursery stock, especially quince. From Sandwich Islands (A. Kœbele), and from United States of America.

INSECTS INJURING STONE-FRUIT TREES.

PEACH.

Pernicious or St. José Scale (*Aspidiotus perniciosus, vid.* "Apple").

Indian Peach Maggot (*Rivellia persicæ*, Bigot). Pest of similar habit to the common fruit maggot of Queensland and New South Wales. In fruit from India. (E. C. Cotes.)

East Indian Fruit Maggot (*Ceoratitis capitata*, Wied.). Pest of similar habit to the common fruit maggot of Queensland and New South Wales. In fruit. From East Indies, Western Australia, Cape of Good Hope, &c.

Japanese Peach Fruit-worm (*Carpocapsa*, sp.). Regarding this pest and its depredations in Japan, it has been stated as follows:—"Peach crop rendered almost a complete failure, so far at least as the quality of the fruit is concerned, by the attacks of a small lepidopterous larva which bores the fruit, causes it to decay, prevents it coming to a sound maturity and ripening in a marketable condition." *Insect Life*, vol. i., p. 58. 1888.† In the soil of orchards wherein peaches are grown, used in packing nursery stock. From Japan.

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* The following testimonies are significant:—"I am sorry to say that the cherry-leach is spreading with great rapidity. It is only six years since it first made its appearance from New Zealand, but it is now all over Southern Tasmania."—E. H. Thompson, *Insect Life*, vi., p. 37, Ap. 1893.

"Said to be the worst enemy with which growers of fruit have to contend."—C. French. Second Report, p. 101.

† Further information regarding this insect pest is afforded by an article entitled "The Japanese Peach Fruit-worm." *Insect Life*, ii., No. 3, pp. 66-68, Sept. 1889, wherein are recorded the observations of Professor C. Sasaki.

Florida Round Peach Scale (*Diaspis lanatus*, Morgan and Cockerell). Occurs also on cherry and plum. With regard to its pernicious work in Florida, it was stated in 1893 that it was "destroying a large number of peach and plum trees in this section."* On nursery stock comprising peach, cherry, and plum trees, and on many ornamental and garden plants from Japan, Ceylon, United States of America (Florida, &c.), West Indies (Jamaica, &c.).

APRICOT.

Pernicious or St. José Scale (*Aspidiotus perniciosus*, *vid.* "Apple").

Brown Soft Scale (*Lecanium armeniacum*, Craw). On nursery stock, especially comprising apricot trees. From the United States of America, &c.

East Indian Fruit Maggot (*Ceratitis capitata*, Wied, *vid.* "Peach").

PLUM.

Pernicious or St. José Scale (*Aspidiotus perniciosus*, *vid.* "Apple").

Florida Round Peach Scale (*Diaspis lanatus*, M. and C., *vid.* "Peach").

Plum Curculio (*Conotrachelus nenuphar*, Herbst.). A weevil that deposits its eggs in the fruit, several in each, the resulting grubs afterwards feeding on pulp of same. "The Plum curculio has made a crop almost impossible in New Jersey."—J. B. Smith, *Insect Life*, iv. p. 45. In fruit (plums and apples), and in soil containing nursery stock from United States of America, British Columbia, and Victoria.

Plum-Gouger (*Coccotorus scutellaris*). Attacking fruit of plum. In fruit or in soil containing plants. From United States of America.

Plum Borer (*Euzophera semifuneralis*, Walk). In fruit and in excrescences of plum trees (known as "black knobs"). From United States of America.

CHERRY.

Florida Round Peach Scale (*Aspidiotus lanatus*, M. and C., *vid.* "Peach").

Leaf Slug (*Eriocampa cerasi*, Peck, *vid.* "Pear"). Known in Tasmania as the "Cherry Leach."

Fruit Grub† (?) (*Conotrachelus nenuphar*, Herbst., *vid.* "Plum"). Fruit Cherry, &c. From Tasmania.

INSECTS INJURING THE GRAPE VINE.

Phylloxera vastatrix. In addition to the generally recognised methods for the introduction of this pest may be mentioned—first, that which consists in its accidental occurrence on roots or rootlets of plants, derived from soil adjacent to that containing Phylloxera-infested grape vines; and, second, that which consists in its natural occurrence on Phylloxera-resisting American vines, derived from localities in which the pest exists as an indigenous insect has become established.

INSECTS INJURING MORE THAN ONE OF THE FOREGOING PLANTS.

Japan Chafer Beetle (*Adoretus umbrosus*). This insect, that is not commonly met with in its native home, and seldom if ever in gardens there, was first noticed at Hawaii (Sandwich Islands) about six or seven years ago. Already in 1893 it was becoming a serious pest there; the adult beetle being wont to

* S. S. Harvey, *Insect Life*, vi. p. 39. Alexander Craw writes: "Experiments conducted by the entomological department at Washington, D.C., with the strongest and best known insecticides, demonstrated the fact that this is one of the most difficult to kill, as well as one of most pernicious scales known." A Craw, *Fifth Report State Board of Horticulture*, of California, p. 39. 1896.

† Late in 1889 considerable apprehension was excited by the occurrence of a small grub in the fruit of the cherry about Hobart, especially injuring varieties like the Florence and Bigaroo. Mr. Alexander Morton, F.L.S., after examination, expressed the opinion that the pest was the grub of our Plum curculio, *Conotrachelus nenuphar*.—F. M. Webster, *Insect Life*, iii., 480, 1891. This American insect had not at the time which he wrote reached the Pacific slope on the continent, not appearing at British Columbia till 1892. He therefore added "it might not be a bad idea for our Californian fruit-growers to be on the lookout for its importation.

riddle the leaves of many different trees and plants, including (according to A. Craw) orange, grape, peach, rose, and others. Unlike what occurs in the case of the majority of scarabæid beetles, *Adoretus umbrosus* undergoes its transformation (beneath the soil) at Hawaii in the short period of seven weeks.* Likely to be introduced in the grub or beetle condition in the soil of boxes containing growing plants, or in decaying vegetable matter from Sandwich Islands or from Japan.

Vine Weevil (*Otiorhynchus sulcatus*). A small beetle, that when adult consumes the leaves of various plants, and that as a larva gnaws their roots and rootlets, injuring in this way not only the vine but various fruit trees. Introducable in soil containing plants either as a grub or nymph. From Europe and South Australia, being already introduced in latter locality.†

Vine Weevil (*Otiorhynchus picipes*, Fabr.). Of like habits. Similarly from Europe.

Burrowing Scale Insect (*Chionaspis biclavis*, Comstock). A scale insect living under the outer skin of the bark, infesting orange, coffee, guava, gardenia, and various shade trees. Introducable on nursery stock comprising the above plants from the Sandwich Islands, Tahiti, and Southern Mexico. Of "a cargo of 325,000 orange-trees that arrived at San Pedro (California) from Tahiti on 15th June, 1891," Alexander Craw writes, "The trees were fumigated five times with double and treble strength hydrocyanic acid gas, and dipped twice in a strong caustic solution, with the result that the trees were injured, but sufficient scales survived to justify legal proceedings being instituted against the trees as a nuisance. . . The trees were destroyed."‡

Mealy Bugs—(1) *Dactylopius vastator*, Mask.; (2) *Dactylopius ceriferus*, Newstead. On nursery stock comprising various trees and shrubs; in the soil in which plants are being introduced, and in crevices of boxes and packages that are used in this connection. From Eastern Asiatic ports, including those of China; from the Sandwich Islands and other groups of the South Seas.§ Should either of these insects become established here, it is considered that the ladybird (*Cryptolæmus montrouzieri*), whose predaceous habits as regards mealy bugs were first made known by the writer, would keep it in subjection.

INSECTS INJURING STRAWBERRY.

Strawberry Weevil (*Anthonomus signatus*, Say.). Feeds as a grub within flower-buds, and thus prevents the formation of fruit to the extent of destroying one-half prospective crop. In soil whilst hibernating, or about strawberry plants. From the United States of America.

Victorian Strawberry Beetle (*Rhinaria perdrix*, Pascoe). A weevil the grubs of which tunnel in the central shoots of the plant. A "very serious enemy of strawberry-growers" (C. French). In strawberry plants. From Victoria and Tasmania.

Strawberry Aleyrodes (*Aleyrodes (?) vaporarium*). A minute plant-louse occurring on foliage. On strawberry plants and other nursery stock. From United States of America and elsewhere. It has been already widely disseminated, on stove plants, in other countries.

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* *Cf.* A. Kœbele. Report of the Entomologist of the Hawaiian Government. "Planters' Monthly," Honolulu. Feb. 1897.

† *Vid.* A Lunardoni, *Gli Insètti Nocivi*, p. 336, 1889; and G. Quinn, Journal Bureau Agr. of S. Austr., Ap. 1897, p. 282.

‡ Fifth Report of State Board of Hort., California, 1895-6, pp. 356.

§ Concerning these two scale insects, the following facts have been recorded :—

"*Dactylopius vastator*, Mask. Most of the shrubs and trees were so infested by the then recently introduced and most pernicious of coccids ever met with (*Dactylopius perniciosus*, Mask.), that their destruction in the near future seemed imminent, had not relief been brought. . . . The coccid is a native of China, where it had been met with in the neighbourhood of Hongkong."—A. Koebele, "Planters' Monthly," Honolulu, Feb. 1897, p. 67.

"*Dactylopius ceriferus*, Newst. Another numerous scale insect, and one that had longer been introduced than the previous species (*i.e.*, *D. vastator*)—viz., *Dact. ceriferus*—had always been seen covering the leguminous trees, often to such an extent that many of them lost their entire leaves, and in some instances even were destroyed entirely by the quantities of mealy bugs present."—A. Kœbele. Report of the Entomologist of the Hawaiian Government, 1896. *Op. cit.*

INSECTS INJURING CITRACEOUS PLANTS.

Perak Pomelo Moth (*Nephopteryx sagitiferella*, Moore*). (*Fam.*, Phycitidæ.) A small moth that lays several eggs at one spot on the rind of the fruit, the resulting caterpillars penetrating to and tunnelling through and through the pulp. Injuring pomoloes, lemons, limes, and other Citraceæ. In fruit, and in soil in which nursery stock is packed. From Perak and the Malay Archipelago generally.

Orange Fruit Flies—(1) *Ceratitis capitata*, Wied. In fruit—not necessarily citraceous—or in parcels or packages that have contained the same, and in soil. From East Indies, Western Australia, or Jamaica. (2) *C. catoirei*, Guérin Meneville. Similarly. From Mauritius and Bourbon. (3) *C. hispanica*, De Brême. Similarly. From Mediterranean provinces.

Oranges Aleyrodes *or* White Fly (*Aleyrodes citri*, Riley and Howard). Small insect—ultimately winged—thickly crowding under surface of leaves. On nursery stock comprising citraceous plants. From Florida, Louisiana, and other of the United States of America.

Orange Scale Insects—(1) *Aspidiotus longispina*, Morgan. On fruit nursery stock, comprising Citraceæ, mango, fig, &c. From China and Sandwich Islands. (A. Koebele).† (2) *Aspidiotus albopunctatus*, Cockerell. On oranges, &c., and on nursery stock, comprising Citraceæ. From Japan. (A. Craw). (3) *Aspidiotus duplex*, Cockerell. Similarly, and from same region. (A. Craw). (4) *Chionaspis biclavis*, Comstock (*vid.* pg. 37). From Sandwich Islands, Tahiti, Mexico, &c.. (5) †*Mytilaspis citricola*, Pack. (*M. flavescens*, Targ. Toz.). On oranges, lemons, &c., and on nursery stocks, comprising citraceous plants, Murraya, croton, holly, &c. From Mediterranean region, Florida, South Seas, &c. (6) *Parlatoria pergandi*, Comstock. On citraceous fruit and on citraceous nursery stock. From Florida. (7) *Parlatoria zizyphi*, Lucas. On citraceous fruit, and on citraceous and other nursery stock. From China and Sandwich Islands. (A. Koebele, *op. cit.*) And from Mediterranean provinces and Batavia. (H. T.) (8) *Ceroplastes floridensis*, Comstock. Florida wax scale. On nursery stock, comprising various plants, including citraceous ones. From Florida and West Indies. (9) *Ceroplastes cirrhipediformis*. On nursery stock, citraceous, ilex, persimmon, &c. From Florida.

INSECTS INJURING THE OLIVE.

Olive Pollinia (*Pollinia costæ*, Targ. Toz.) A scale insect. On olive truncheons from the Mediterranean provinces.

INSECTS INJURING COFFEE.

Burrowing Scale (*Chionaspis biclavis, vid.* "Orange").

Green Bug (*Lecanium viride*, Green).‡ On nursery stock, including Citraceæ mango, guavo, tea, &c. From South India and Ceylon.

Coffee Mealy Bug (*Dactylopius adonidum*, Linn.)§ Upon nursery stock comprising various ornamental plants, and in soil about the roots of same, and in plant cases and packages. From India and from Sandwich Islands and other parts of South Seas.

Coffee Aleyrodes. On nursery stock. From South Seas.

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* Wray, Ind. Mus. Notes, vol. ii., No. 1, pp. 21-24, 1891.

† Rept. of Entomologist of Hawaiian Gov., Plant. Month., Feb. 1897, *pass.*

‡ "Since the publication of J. Neitner's 'The Enemies of the Coffee Tree,' many new enemies have made their appearance, notably the *Lecanium viride*, which has practically wiped out coffee cultivation in many districts. Its vigour, and the rapidity with which it is propagated, have defeated any remedial measures that we could afford to apply, and consequently planters are everywhere turning their attention to the cultivation of tea in the place of coffee."—E. E. Green.

§ "*Dactylopius adonidum*, Linnæus, has been present upon most all plants. It is the scale that has marred the coffee industry in the Islands [*i.e.*, Sandwich Islands, H. T.] ever since the attempt was made to grow the tree, over fifty years since, by its large numbers sitting round and sucking out the sap of the young berries, producing a premature colouring and dropping of the same. It likewise lives upon the roots, not only of the coffee, but many other trees and plants in the tropics."—A. Koebele. Report of Entomologist of Hawaiian Government, 1896. *Plant. Month, Honolulu, February*, 1897, *pages* 68 *and* 69.

INSECTS INJURING MANGO.

Green Bug (*Lecanium viride*, Green, *vid.* "Coffee," p. 38.)

Mango Fruit Maggot (*Dacus ferrugineus*, Fabr.). Pest with habits corresponding to those of common Queensland and New South Wales fruit maggot. Does considerable damage to fruit—(E. C. Cotes). In fruit or soil of Dacus-infested plantations. From India, &c.

INSECTS INJURING HOPS.

Hop Plant Louse (*Phorodon humuli*). A very injurious insect. On nursery stock, consisting of plum trees, on roots of which it winters in the egg state. From the United States of America and from Tasmania, where it has already become established.—E. H. Thompson.

INSECTS INJURING DATE-PALM.

Eastern Palm Weevil (*Rhyncophorus ferrugineus*, Oliv.). In various palm plants. From India and Singapore. The larvæ of this large weevil are white legless grubs; they tunnel into the trunks of date (*Phœnix dactylifera*), cocoanut (*Cocos nucifera*), and other palms in India, and kill a large number of trees.

American Palm Weevil (*Rhyncophorus cruentatus*). Said to "eat bulbs of date palms, and destroy these plants in Florida." In all kinds of small palm plants. From Florida and West Indies.

Date Palm Scale (*Parlatoria victrix*, Cockerell). On palm plants from Egypt.—A. Craw.

INSECTS INJURING COCOANUTS.

Eastern Palm Weevil (*Rhyncophorus ferrugineus*, Oliv., *vid.* "Date Palm").

American Palm Weevil (*Rhyncophorus palmarum*, Linn.). In various palm plants from South America and Southern California.

Ceylon Cocoanut Palm Weevil (*Sphenophorus panipennis*, Nietner). In palm plants. From Ceylon.

Palm Scale Insect (*Diaspis vandalicus*, Galveg.). Concerning its work at Havana we have the following testimony:—"Disease due to this, killing many cocoanut palms, and at one time almost threatened to annihilate all the plantations producing cocoanuts for markets and export." (Otto E. Reimer). On cocoanuts. From West Indies and elsewhere.

Palm Scale Insect (*Aspidiotus destructor*, Signoret).* Said to be extremely destructive to scale insects (E. C. Cotes). On cocoanuts. From Laccadive Islands (India), Reunion, &c.

Cocoanut Palm Defoliator (gen. et sp.?).† Very injurious to the foliage of the cocoanut in Fiji; even threatening destruction of this palm there.—(A. Koebele.) Occurring also apparently in British New Guinea.—H.T. On the leaves of growing palms and in cocoanut leaves used in packing. From Fiji and other South Sea Island groups.

Cocoanut Palm Mealy Wing (*Aleurodicus cocois*, Curtis). Injurious to foliage. On palm plants. From the West Indian Islands.

INSECTS INJURIOUS TO PULSE (COWPEA, &c.)

Large Grey Pea Weevil (*Bruchus emarginatus*, Allard). In peas (*Pisum sativum*). From India, &c.

Red-legged Pea Weevil (*Bruchus rufimanus*, Boh.). In peas and broad beans. From Europe.

Four-spotted Bean Weevil (*Bruchus quadrimaculatus*, Fabr.) In table beans. From Europe and America.

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* "A minute insect that to the naked eye looks like a mealy scurf on leaves. It has been reported as extremely destructive to cocoanuts (*Cocos nucifera*), palms. . . . It sucks up the juice of the leaves to such an extent as to sap the vitality of the trees and to destroy great numbers of them." (E. C. Cotes.)

† "A small black pyromorphid, closely related to our *Acoloithus* and *Harrisonia*."—C. V. Riley. *Insect Life*, v. 270. 1893.

NOTE.—*Bruchus pisorum*, Linn., *Bruchus obtectus*, Say., and *Bruchus chinensis* have been detected on stored peas and beans in Brisbane seed-stores; and if not generally disseminated or established where cowpeas, peas, and beans are grown, should be added.—*Vid.* H. Tryon, "Bean and Pea Weevils." Trans. Nat. Hist. Soc. of Qd., vol. i., pp. 16-20. 1891.

INSECTS INJURIOUS TO CEREALS.

Wheat Midge (*Diplosis tritici*, Kirby). Larvæ live within flowering glumes and cause abortion of grain. In soil or other vehicle containing pupæ. From Europe and the United States of America (formerly introduced to this region).

Hessian Fly (*Cecidomyia destructor*). In straw and hay packing, and in grain badly cleaned and containing the pupæ (the so-called "flax seeds"). From Europe, the United States, and New Zealand, being introduced within recent years to the this southermost Australian colony.*

European Saw Fly (*Cephus pygmæus*, Linn.) From Europe or America; introduced to latter country. Importation to Queensland not highly probable.

Wheat Stem Maggot (*Meromyza*, sp.) Breeds freely in several kinds of grasses besides doing so in wheat stalks. In straw and grass in packages. From the United States of America and Canada (*vid.* "Report, Canadian Entomologist, 1889").

Joint Worm (*Isoma tritici*). This hymenopterous insect is stated to do a considerable amount of injury in wheat-growing districts. In straw used as packing, since insect hibernates within the stalks. From the United States of America and elsewhere.

Gran Aphis (*Toxoptera graminum*, Boisd.). Attacks oats and other cereals. Introduced formerly into America from Europe, and therefore a possible importation to Australia. From European countries, including Mediterranean provinces.

INSECTS INJURING MAIZE.

Sugar-cane Moth-borer (*Diatræa saccharalis*, Fabr., *vide* "Sugar-cane"). In cane "sets."

Sugar-cane Beetle (*Ligyrus rugiceps*, Lec.). Stated to be "the worst insect enemy of the corn plant on heavy wet land" in Missouri, U.S.A. (*vide* "Insect Life," I. 217). In cane "sets." *Vide* "Sugar-cane."

Corn Root-borers (*Diabrotica longicornis*, Say., and *D.* 12-*punctata*, Oliv.). The former insect, the grub of a beetle, has been stated to have "become a terrible pest in fields of Indian corn all over the Western States of America" (F. M. Webster). In soil containing the roots of growing plants. From North America. Introduction not highly probable.

INSECTS INJURING SUGAR-CANE.

Moth Stalk-borer (*Diatræa saccharalis*, Fabr.).† This destructive borer does not appear to have become established in Queensland. Attacks also maize and sorghum. In sets of sugar-cane from East Indies, India, Mauritius, and Louisiana.

Javanese Stalk-borers‡ (*Scirpophaga intacta*, Snell., *Grapholitha schiztaceana*, Snell., and *Chilo infuscatellus*, Snell.)

Beetle-borers (*Sphenophorus obscurus*, Boisd., and *Sphenophorus sacchari*, Guilding). Highly destructive insects (*vide* "Insect Life," i. p. 185). Also damaging banana. In sugar-cane or cane "sets" and in banana stools. From the Sandwich Islands, New Ireland, New Guinea, Tahiti, West Indian Islands, and South America.

American Sugar-cane Beetle (*Ligyrus rugiceps*, Lec.). In sugar-cane or cane "sets." From Louisiana (*vide* "Report Div. Ent. Rep. Dep. Ag. U.S.A. 1880").

INSECTS INJURING BANANA.

Beetle Borers (*Sphenophorus spp.*). *Vide* "Sugar-cane." Cane plants and "sets" and banana stools. From British New Guinea, Sandwich Islands, &c.

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* *Cf.* T. W. Kirk.—"Report of Acting Biologist," "2nd Report Department of Agriculture, New Zealand," pp. 81-87, Wellington, 1894; and H. Tryon, "Journal of the National and Agricultural Association," No. 24, Brisbane, 26th May, 1888.

† That the stalk-borers belonging to the genus Diatræa, occurring in South America, Mauritius, India, and the East Indies, are referable to a single species is at least doubtful.

‡ Dr. W. Kruger. *Berichte der Versuchsstation für Zuckerrohr in West Java.* Heft I., Dresden, 1890.

Apiculture.

BEE-KEEPING FOR EXTRACTED HONEY.

By H. STEPHENS.

Part I.

The best time to commence with bees is in the spring, about September, or as soon as the cold weather is over, although they may be got at any time during the summer; but the earlier in the season the better, as they will have a longer time in which to gather honey before the winter, and will pay for themselves in the first season with ordinary care, and if a swarm can be secured, the expense of starting is very trifling. Most people have seen a swarm of bees hanging to the branch of a tree, and have no doubt kept at a safe distance away from them; but those who wish to become bee-keepers must not be afraid of stings, and bees, when they have swarmed, are not generally disposed to use their stings unless too roughly handled, as before leaving the hive the worker bees fill themselves with honey, and a bee in that state is like a man after a good dinner—not inclined to be quarrelsome. If a swarm of bees settles on a branch that can be conveniently cut off, they may be carried where you wish, of course within a reasonable distance; but it is best to make a cut on the underside of the branch first, as if this is not done the branch when cut through may hang by the bark; but it often happens that the bees are not so obliging as to cluster on a branch of this kind, in which case they have to be secured by means of a box or swarm-catcher, and the plan of working is then as follows:—

When the bees are nearly all clustered, place or hold the box underneath the swarm; and then with the other hand sharply jerk the branch they are on, when they will fall into the box, which must be closed at once with anything that will keep the bees from escaping, and if the queen-bee is inside they will remain quietly with her, and may be left in a shady place till a hive can be prepared, which should only require putting in position, as it does not do to be behind with things, but everything should be ready beforehand. Of course they may be left in the box they were caught in; and if an entrance is made in the lower edge, and the box placed on a piece of board to form a bottom, the bees will go to work and start building comb just as if they were in the best frame hive; but most people who commence bee-keeping will wish to start right, and keeping bees in box hives is neither starting right nor most profitably. The proper hive to use is what is known as the frame hive; because the bees, instead of fixing their combs to the sides of the hives, are made to fix them into light wooden frames which hang from a rebate in the top edge of the hive, thus permitting the combs to be lifted out when necessary for observation. This is a very great advantage, and has made bee-keeping pleasant and easy as compared with the old methods, when much was left to chance. The plan of having the combs built in frames was first invented by Rev. L. L. Langstroth, and the frame hive is in consequence known as the Langstroth hive.

The usual number of frames in a beehive in this colony is ten, but some beekeepers use an eight-frame hive, which has exactly the same sized frames. In this paper the ten-frame hive will always be meant, as that is the kind most generally used.*

* Full details are given here by the author for the construction of a perfect frame hive. Exigencies of space, however, compel us to omit this portion of the paper.

WAX FOUNDATION.

After the frames are wired they are filled with sheets of "foundation," which is simply wax made into sheets and passed between two rollers that impress them with the bottoms of the cells. This saves the bees so much extra labour; and as bees use from 12 to 14 lb. of honey to make one pound of wax, the advantage of using whole sheets of foundation is obvious; also, as all worker foundation may be used, the production of undesirable drones is kept in check, and honey is also saved in that way. There are three kinds of foundation made—thick, medium, and thin (for comb honey). The two first are used for honey to be extracted. The price is 2s. per lb., and the approximate number of sheets to the lb. is—

Thick broad foundation	5 sheets
Medium	7 ,,
Thin for section boxes	26 half-sheets.

WIRE EMBEDDER.

The foundation is fixed into the frames with what is called a "wire embedder," of which the Easter day is a useful kind. It is made of tin, and the wire is pressed into the wax by a rocking motion of the tool.

Before putting the foundation into the frames a piece of board should be provided, cut to fit easily into the inside of the frame; and the wax should be slightly warmed and laid on this board, the frame placed over it, and the wires pressed in.

OILCLOTH MATS.

On top of the frames and underneath the cover, a mat of oil, or American cloth is placed, with the oil side down. The purpose of it is to prevent the bees from sticking the cover down, and to permit the bee-keeper to expose the frames gradually by gently peeling the mat off by one corner. They are best kept without holes, as it is more convenient in working the bees; the cover of the hive also should be kept tight to prevent the ingress of rain.

Now, to get back to the swarm of bees that were left in the box in a shaded place. They have now to be placed in the frame hive, which is effected by moving the frames to each side and shaking the bees down into the centre of the hive. If it is a very large swarm, some frames may have to be removed and be replaced afterwards when the bees get settled. The mat and cover are next put on, brushing any bees away that may be in the road. If it is a good swarm and the queen is there, they will go to work at once to draw out the the foundation, usually the centre frames first; and when they have the comb built the bees will bring in pollen and honey, and the queen will commence laying.

About a couple of hours after the bees are hived, it will be necessary to examine the hive to see if they are working properly and that the foundation is not falling out of the frames, as it sometimes does if not put in firmly, thus preventing the bees from building nice straight combs. If they are going on well they may be left alone for two or three days, but for a beginner with bees it is just as well to look at them often, as he thus makes himself familiar with their method of working, which is very simple when once learnt. A smoker and a bee-veil are necessary in order to enable the observer to examine bees in comfort. When the smoker is burning well, the cover must be lifted off the hive. Then the oilcloth mat must be gently peeled off, some smoke being blown on to the bees at the same time. After the mat is off, one of the centre frames is gently lifted out and search made for eggs and young larvæ in the cells. A bee's egg being very small, a novice may have some difficulty at first in detecting it, but if the comb be held in the right light it may easily be seen.

If eggs are seen, it is tolerably certain that the queen is all right, so there is no necessity to look for a queen every time the hive is opened; only the eggs need be sought for. As soon as a queen is lost the bees will start queen cells with these eggs or young larvæ, except at the swarming season, when they

make cells whilst the queen is still there. If a centre frame cannot be got out without crushing the bees, one of the side frames must be removed and placed alongside the hive; then the others are moved along till one is found with eggs and brood in it. If there are plenty of eggs and brood in the hive, it is all right; also it must be noticed if they are cramped for room. If so, the honey-board is put on and a super or top story added, filled with frames of foundation or with empty combs. In a strong colony the queen lays for nine months in the year, and only takes a rest in the winter time or during a scarcity of honey, and it has been estimated that a prolific queen lays from 2,000 to 3,000 eggs daily, but she would probably lay that number for a short period only. In three days after the eggs are laid they will hatch out into small larvæ or grubs, and the bees feed these larvæ with a mixture of pollen and honey, partially digested, for a period of nine or ten days from the time the eggs were laid. They then seal the mouth of the cell up, and the young worker bee hatches out after eleven or twelve days, or about twenty-one days from the time the egg was laid. The queen takes only sixteen days to hatch, and the drone the longest time of all, hatching out twenty-four or twenty-five days from the laying of the egg. After the hive is full of honey and brood, provision must be made for giving the bees more room, so another hive body will be required with ten frames of comb or foundation, which is placed upon the lower one with a "queen excluder" or zinc honey-board between them, the object of which is to prevent the queen and drones from coming into the top story or super and the queen from laying there, for the super is for honey alone, and the queen should be given plenty of room in the lower hive or brood-nest. As the combs in the super are filled with honey the bees will seal the cells over, and it is the honey that is taken from sealed combs that is the best and thickest, as it has then been ripened. Bees usually commence storing honey in the centre frames first, and as these are being filled they may be moved to the side of the hive and replaced with the empty ones, so as to fill the super up in every frame regularly. When the brood-nest and super are filled with honey and brood, the bees make preparations for swarming by building shallow queen-cells (which resemble the cup of an acorn in shape), and in each of these cells, if she is ready, the queen lays a worker egg, which, just before hatching, the bees liberally supply with a very concentrated food called "royal jelly," supposed to be similar to that supplied to every young worker larvæ, only a great deal richer. This food is given freely during the whole of the larva period, and after nine days from the time the egg was laid the queen cell is sealed up, and the young queen hatches out in about one week more, or sixteen days from the laying of the egg. But before the cells hatch out, the swarm will leave with part of the bees, and the first hatched queen will destroy the other cells; but it is probable that the bees help her to do so, and sometimes, instead of the queen destroying the cells, she will lead out another swarm—that is, if the colony is sufficiently strong. All swarms after the first swarm are called after-swarms, and are accompanied by virgin queens. They are more difficult to hive than first swarms, and will generally fly farther from the hive before they cluster, as the queens are more active. It is desirable to give an after-swarm a frame of eggs and young brood, as it holds them together better, and lessens the chance of their leaving the hive. In fact, it is a good plan to give all newly hived swarms a frame of eggs or young larvæ, as they go to work better when so supplied, and it enables one to tell if the queen is there, as if she is lost, the bees will start queen cells with the eggs or larvæ; and, as before-mentioned, there is no need to trouble to look for the queen often, because if eggs are present the queen must have been there within three days. When the super or top story is filled with honey it may be extracted, but first of all the bees will have to be removed from the combs, so each frame must be lifted out and jerked sharply in front of the entrance of the hive, and any bees left on the combs brushed off with a bee-brush or a bunch of soft grass or leaves. But a much better way to get the bees off the combs is to use a bee-escaper or super-clearer, which, when the honey is ready to extract, is put between the

super and brood-nest, or between a full super and an empty one that is placed where the other was. Then in about six or eight hours, more or less, the bees will have gone through the escape into the lower hive, and the full super may be lifted off without a bee on the combs, or at most only a dozen or so. It may then be carried to the honey-extractor, and the honey taken out and then returned to the bees to fill up again. Anyone who has once used a bee-escape will never trouble to brush the bees off the combs again. In examining a colony of bees that has a super or top story on, the *modus operandi* is as follows:—First remove the flat cover, then lift off the super and place it on the cover. Thus the bees in the super are shut in; if the oilcloth mat is tight as it should be, the bees in the super cannot give trouble while examining the brood-nest. This is an advantage of the flat form of cover, as with a gable cover you cannot lay the super on it, and if you put it directly on the ground, pieces of grass and other matter will stick to the combs. A gable cover allows of more ventilation than the ordinary flat form, and in very warm weather it is desirable to have a well-ventilated hive, as if it is too close and hot the bees will hang in a cluster on the outside of the hive during the warmest part of the day, and of course they would be better occupied doing some useful work; but in places where there are only a few very hot days in the season, the ordinary flat cover does very well, and is simpler to make; but whichever cover is adopted it is best to have them all alike, as if some are flat and others gable they may have to be changed about, and this will give such a different appearance to a hive that the bees will not recognise it. After the super is removed the honey-board must be lifted up by one corner and cleaned of any wax that may have been built there, also the wax and propolis must be scraped off the tops of frames. A tool like a square trowel or scoop about 2½ inches wide is very handy for this purpose, as the pieces of wax and propolis have only then to be shaken into a tin or the comb bucket. If the bees are doing well and gathering honey, the honey-board may be replaced and the super and cover put on.

LOSS OF QUEEN.

It sometimes happens that the bees lose their queen, either through old age or by her being killed in some way. If this happens in a hive where there are worker eggs and young larvæ, it does not matter so much, for they will be able to raise another in about sixteen days from the time the eggs were laid; but it must be noted here that if the worker larvæ which they use to make a queen, is three days old, or six days from the laying of the egg, the queen will hatch out in ten days, so the time when the queen will hatch is governed by the age of the larvæ the bees use; and they seem to have a preference for using those that are rather old, but larvæ one or two days old make the best queens, as they have the benefit of the royal jelly during the whole of the larval period, when an older larva would be to some extent a worker, and the queen from such would not be likely to be so good. But it is when the bees have no eggs or young brood with which to make a queen that the trouble occurs, as if the bees have no means of raising a queen, one of their own number will take upon itself the duties of the queen and will lay eggs too, but these eggs will only hatch into drones. The presence of fertile workers may be suspected if more than one egg is observed in the cells. Sometimes three or four are laid irregularly all over the comb, the cells being skipped about and the eggs not laid in order as is done by a queen, and if the bees are not given a queen they will at last die out. It is best to give also several frames of brood with some hatching brood among it.

DRONES.

The drone is the male bee, and is easily distinguished from the worker or queen by being much larger and by not having any sting or being furnished with pollen baskets on its legs. Its duty is to fertilise the queen, the drone dying as soon as this is accomplished. A queen when once fertilised does not require a second fertilisation, but if through having imperfect wings she is

not able to fly and meet the drone, she will still lay eggs, but they will only produce drones, and she is called a drone-laying queen, and must be replaced with a good queen. A strange thing about drones is that they have only one parent, as the eggs which they are hatched out of are not fertilised. The queen may lay drone or workers' eggs at pleasure, and if there are not sufficient worker cells in the hive, the bees will make use of drone cells by adding a rim of wax round the edge of the cell, and thus reducing the size. If bees are allowed to build comb without using foundation, they will make a quantity of drone comb which is not required, so that is another point in favour of foundation; and full sheets should always be given. Drone brood is distinguished from worker by its larger size and by the rounded appearance of the caps of the cells when sealed. During the winter, and when there is a great scarcity of honey, the worker bees kill off the drones by hunting them out of the hives; but in any colony that has queen cells they will always keep some drones in order to fertilise the queen when she hatches.

(*To be continued.*)

BEE-KEEPERS' ASSOCIATION OF VICTORIA.

The Beekeepers' Association of Victoria is taking vigorous steps towards stamping out foul brood, and a Bill dealing with the subject has been drafted by the solicitors of the Association for introduction into Parliament.

Mr. L. T. Chambers, Honorary Secretary of the Association, writes:—

I have little doubt of the future of our business and the possibility of opening up a foreign trade at a payable price. I have had many ventures, and feel assured that it may be done by the exercise of a little perseverance.

The attempts to find a market in London by the methods adopted in 1895 met the reception that might be expected. But nevertheless there is a good market there and elsewhere in the United Kingdom.

The main difficulty, as I see it, is to be able to supply when we do open a market. For instance, at the beginning of this year, at the request of an English firm, I sent forward a sample case of average Victorian honey, with quotation, and am now faced with an order, "ship 100 cases per month till further advice."

Needless to say that, none can be sent, as only half a crop was gathered in consequence of drought.

A Tropical Industry.

INDIA-RUBBER (CAOUTCHOUC).

By E. COWLEY,
Manager, Kamerunga Nursery Cairns.

It is now about twenty-five years ago that the writer's attention was first directed to India-rubber. It was brought about by meeting a gentleman in Mauritius, who had been sent to Madagascar by a French company to collect caoutchouc. His success had, however, been limited, and he was returning to Europe. Even twenty-five years ago the exigencies of trade demanded a a larger supply of caoutchouc. This demand since that time has been very considerably augmented, so much so that prices have risen owing to the shortage of supply. The cultivation of India-rubber-producing plants has been essayed both in India and in Borneo with considerable success, particularly in India. Up to comparatively recent times India-rubber was obtained by tapping the indigenous trees in the countries in which they grew, and was traded like other natural products to Europeans and Americans. There is no record of caoutchouc being used by any of the ancient nations, notwithstanding the fact that India-rubber is produced from *Ficus elastica*, which is indigenous to India and other Asiatic countries. The best rubber is, however, obtained from South America, and is called "Para rubber." The first notice of India-rubber was given nearly 500 years ago by Herrera, who, in the second voyage of Columbus, observed that the inhabitants of Hagh played a game with balls made "of the gum of a tree," and that the balls bounced better than the balls of Castille (Herrera Historia, dec. 1, lib. iii, cap. IV). Torquemada, however, seems to have been the first to have mentioned by name the tree yielding it. In his "Monarquia Indiana," published at Madrid, 1615, he says: "There is a tree which the Mexican Indians call Ulequahuitl; it is held in great estimation, and grows in the hot country; it is a very high tree; the leaves are round and of an ashy colour. This tree yields a white milky substance, thick and gummy, and in great abundance." He further states that the juice was collected and allowed to settle in calabashes, and was afterwards softened in hot water, or the juice smeared over the body and allowed to dry, when it was rubbed off. The tree mentioned by Torquemada has usually been identified as *Castilloa elastica* (*Cerv.*); but the above account cannot apply to it, as that tree is described by Cervantes as one of the loftiest trees of the north-east coast of Mexico, and its leaves are not round, but oblong-lanceolate. *Castilloa* (probably in commemoration of Castillejo), a genus (containing two or three species) belonging to the order Urticaceæ, and having male and female flowers, alternating one with the other, on the same branch; *C. elastica* contains a milky juice, yielding caoutchouc"—Nicholson, A.L.S., Dictionary of Gardening. Even at that early date the Spaniards used the juice of the "ube-tree" to waterproof their cloaks. The fact, however, did not attract attention in the old world, and no rubber seems to have reached Europe until long afterwards.

The first accurate information concerning any of the caoutchouc trees was furnished by La Condamine, who was sent in 1755 by the French Government to measure an arc of the meridian near Quito. In 1751 the researches of M. Fresnau, an engineer residing in French Guiana, were published by the French Academy; and in 1755 M. Aubht described the species yielding caoutchouc in French Guiana. Nevertheless, India-rubber remained for some time unknown in England, except as a curiosity; for Dr. Priestly, in the preface to his work on "perspective," called attention to it as a novelty for erasing pencil-marks, and states that it was sold in pieces of cubic half-inches for 3s. each. Most readers of about fifty years of age will remember it in somewhat similar sizes

used in schools, but will remember it in no other form, except, perhaps, in what was known as mackintoshes or waterproof coats. It was not, however, until the beginning of the 18th century that the India-rubber industry really commenced. The rapid progress that this has made during the present half-century may be perceived by a glance at the following tables, which have been taken from the last edition of the "Encyclopædia Britannica":—Imported into England in 1830, 464 cwt.; in 1840, 6,640 cwt.; in 1850, 7,616 cwt.; in 1870, 152,118 cwt ; in 1879, 150,601 cwt. It has been computed that in 1870 there were in Europe and America more than 150 manufactories, each employing from 400 to 500 operatives, and consuming more than 10,000,000 lb. of caoutchouc. The imports into the United States of America have largely increased during the few last years preceding 1879; at the time of writing this has been still more increased.

Caoutchouc-yielding trees appear to be found in that tropical strip of the earth's surface included within 10 degrees of latitude on each side of the equator; yet the quantities supplied from this huge belt, of the better kind of rubber, fail to satisfy the demand. This demand is yearly increasing, and it is not unlikely that some substance will eventually be found as a substitute. The varieties which are almost exclusively used when great elasticity and durability are required are the "Para," "Ceara," and "Madagascar" rubbers. There are others of less value from Mozambique, West Africa, Assam, Borneo, Rangoon, Singapore, Penang, and Java, &c. The best of all and the most valuable in the markets of the world is the "Para." This is the product of *Hevea braziliensis* (Mull., Arg.). Mr. Nicholson, A.L.S., in his Dictionary of Gardening, gives the following account of this tree:—

Hevea (from *Hevé*, a vernacular name in Northern South America); syn. *Micranda siphonia*, Ord. Euphorbiaceæ. A genus comprising nine species, of tall stove trees, natives of the damp forests of tropical America. Flowers in dichotomous cymes. Leaves alternate, on long petioles, digitately 5-foliate; leaflets petiolate, entire. Of the two or three species yet introduced [into Great Britain] the best known is the one here described. It succeeds in a sandy loam. Propagated by cuttings, made of half-ripened wood, and inserted in sand, under a hand glass, in heat. *H. braziliensis* (Brazilian); flowers green, white in May; leaves light-green, digitately trifoliate; height, 60 feet. Tropical South America, 1823. This plant furnishes the well-known Para rubber of commerce (Encyclopædia of Horticulture, p. 140).

An effort to introduce this plant was made by the Department of Agriculture by means of seed, but the nuts were found to be unfertile on arrival at Kamerunga. It is not at all certain that *Hevea braziliensis* is likely to flourish even in North Queensland, except, perhaps, at the extreme end of York Peninsula, or on some of the numerous islands surrounding Thursday Island. The whole of British New Guinea is included in what may be called the caoutchouc-producing latitude, and the introduction of *Hevea braziliensis* would probably be found to well repay an effort to acclimatise it on some of the river banks of that possession, particularly at the east end, where the rainfall is considerable. It would seem that other species of *Hevea*, as well as *Micranda siphonoides*, which grows in the valley of the Amazon and its tributaries, are used by the natives indiscriminately to furnish "Para" rubber. All these trees seem to flourish best on rich alluvial clay slopes by the side of rivers where there is a certain amount of drainage, and the temperature reaches from 89 degrees to 94 degrees F. at noon, and is never cooler than 73 degrees F. at night, while rain is seldom absent for ten days together.

Nowhere in North Queensland do these conditions prevail. The minimum thermometer has been known to go very low into the forties at Kamerunga, and dry weather has prevailed for about three months at a time, so that, except for curiosity, it would not seem advisable to undertake the culture of *Hevea braziliensis* or of any of its congeners in our Northern territories. It may, however, be instructive to persons interested to learn how Para rubber is collected. The caoutchouc is collected in the so-called dry season, between August and February, which would correspond with the Queensland season between April and September.

The trees are tapped in the evening, and the juice is collected on the following morning. To obtain the juice, a deep horizontal incision is made near the base of the tree, and thence a vertical cut extends up the trunk, with others at short distances in an oblique direction. Small shallow cups made from the clayey soil and dried in the sun are then placed below the incisions to receive the milk, each cup being attached by sticking a small piece of clay to the tree and pressing the cup against it. The juice each tree yields is about 6 oz. in three days. It has a strong ammoniacal odour, which rapidly goes off, and in consequence of the loss of ammonia it will not keep longer than a day unchanged; hence when it has to be carried to a distance from the place of collection, 3 per cent. of liquid ammonia is added. The juice is said by Bruce Marren to yield half its weight of caoutchouc, but 30 per cent. appears to be the usual quantity. To obtain the rubber the juice is heated in the following manner:—A piece of wood about 3 feet long, with a flattened clayey mould at one end of it, is dipped in the milk, or the latter is poured over it as evenly as possible. The milk is then carefully dried by turning the mould round and round in a white vapour obtained by heating certain oily palm-nuts (those of *Attalea excelsa* being much preferred), the vapour being confined within certain limits by the narrowness of the neck of the pot in which the nuts are heated. Each layer of rubber is allowed to become firm before adding another. A practical hand can make 5 or 6 lb. in an hour. From whatever cause, the rubber thus prepared is the finest that can be obtained. The flat rounded cakes made in this manner are known in the London market as "Biscuits."

(*To be continued.*)

Farmers' Conference.

AT THE AGRICULTURAL COLLEGE, GATTON, 10TH, 11TH, AND 12TH JUNE, 1897.

AT the invitation of the Minister for Agriculture, a large number of delegates from various farming centres in the Northern, Central, Western, and Southern districts of Queensland assembled in conference at the Gatton Agricultural College on the above date. The Conference was carried on for three days, three sessions being held on each day. There were present :—

Chairman: Hon. A. J. Thynne, M.L.C., Secretary for Agriculture.

Delegates: Eastern Downs Horticultural and Agricultural Association (Warwick)—Jas. Wilson and W. D. Lamb. Central Downs Agricultural and Horticultural Association (Allora)—W. Deacon and G. Moulday. Border Agricultural, Horticultural, Pastoral, and Mining Society (Stanthorpe)—R. Hoggan and K. W. Scholz. Drayton and Toowoomba Agricultural and Horticultural Society (Toowoomba)—W. R. Robinson and W. C. Peak. Wallumbilla Farmers' Association—Geo. Williamson and T. W. Caswell. Logan Farmers' and Industrial Association (Loganholme)—A. Watt and Thos. Armstrong. Logan and Albert Agricultural and Pastoral Society (Beaudesert)—W. H. Stephens and M. S. Smith. Agricultural and Pastoral Society of Southern Queensland (Beenleigh)— —. Savage. Burpengary Farmers' Association—J. A. Bourke and J. F. Fountain. United Pastoralists' Association of Queensland (Brisbane)—C. W. Murray. Zillmere Horticultural Society—S. Lang and H. Robinson. Lockyer Agricultural and Industrial Society (Laidley)—A. Philp, jun., and M. O'Keefe. Rosewood Farmers' Club—H. M. Stephens and T. E. Coulson. Ipswich and West Moreton Agricultural and Horticultural Society (Ipswich)—H. T. Hooper and P. W. Cameron. Gympie Agricultural, Mining, and Pastoral Society—S. Harding. Pialba Farmers' Association—J. B. Stephens. Wide Bay and Burnett Pastoral and Agricultural Society (Maryborough)—J. E. Noakes and Geo. Stuckey. Biggenden Progress Association—A. W. Baulch and J. H. Simpson. Degilbo Progress Association (Woowoonga)—F. A. Griffiths and H. B. Griffiths. South Isis Planters' and Farmers' Association—T. H. Wells and H. Epps. North Isis Cane-Growers' Association—A. C. Walker and W. J. Young. Central Queensland Farmers' and Selectors' Association (Coowonga, Rockhampton)—T. Whiteley and E. Adams. Marathon Pastoral and Agricultural Society (Longreach)—J. H. McConnell. Pioneer River Farmers' Association (Mackay)—E. Denman and E. Swayne. Herbert River Pastoral and Agricultural Association (Ingham)—J. Lely.

Officers of the Agricultural Department: P. McLean (Under Secretary for Agriculture), Professor Shelton (Instructor in Agriculture), J. C. Brünnich (chemist), John Mahon (dairy expert), A. H. Benson (fruit expert), A. J. Boyd (editor of the "Queensland Agricultural Journal").

Messrs. J. V. Chataway, M. Battersby, MM.L.A., P. Waller (Neusa Vale), and W. Soutter (Acclimatisation Society) were also present.

FIRST SESSION.

Thursday, 10th June, 1897, 11 a.m.

CHAIRMAN'S ADDRESS.

The Chairman (Hon. A. J. Thynne) said: Gentlemen,—Before opening this Conference I think it behoves me to say a few words upon the business we have in hand, and generally upon the subject of agriculture. I think, however, I cannot begin saying anything before offering to you all a most cordial welcome to this, the Agricultural College of Queensland. To me it is an element of the greatest possible satisfaction that the first Farmers' Conference that it has been my fortune to preside over, should hold its meeting in this College, and I am sure that your sympathy and support will be enlisted and secured in the objects for which this institution is established. I have to express personally my great obligation to the representatives of the different societies for the hearty way in which they have accepted the invitation of the Department to attend the Conference; and if there can be any degree of cordiality in this welcome, I should say that those gentlemen who have come great distances from the North are entitled to a greater welcome than the others. On behalf of the farmers of the South, we welcome among us the farmers from the North, to join with us in discussing matters of general agricultural interest. Whatever may be the effect of individual transactions, I am sure the general result will conclusively show that the interests of the agriculturists of one part of the colony are equally the interests of agriculturists all over the rest of the colony. This gathering, representative as it is of nearly the whole colony, is indicative of a desire on the part of agriculturists everywhere to mutually aid and assist each other in the promotion of the agricultural interests of Queensland. I think that in offering to you this welcome to this Conference, I ought in the first place to make some reference to the origin of the idea of holding it. Some months ago the gentlemen connected with the Pioneer River Farmers' Association made a suggestion that such an agricultural conference should be held. At that time my association with the Department was not of a character which would entitle me to make any arrangements for any long period ahead. Later on I felt that if we could arrange a conference so that it could be held in this building, a very great gain would be secured, and therefore as soon as I ascertained the time when the buildings would be available, the invitations for the Conference were sent out.

The objects of the Conference mainly are to discuss matters of mutual interest to the agricultural community. We have on our list a number of very important and very useful subjects which are to be introduced by those gentlemen who have chosen them for their papers, and subjects which have also been suggested for discussion, I will, however, refer to one or two matters which are not included in our syllabus, and to which I think it would be an advantage if the delegates and the farmers generally of Queensland gave some little attention. First, there is the important question of the transportation of produce. I do not think I am at all exaggerating when I say that our methods of handling produce, especially grain produce, are most primitive, and that until some better means of handling grain produce is devised we can never really attain the production of grain which this colony ought to be producing. During last year I happened to be on the Downs, and at one of the railway stations in a grain-growing district I saw a very large number of farmers' teams waiting their opportunity of getting their loads away by rail. I could not help feeling what an unnecessary waste of energy, waste of time, and what a tax it was upon the industry that such a system should continue. I have since given the subject some little consideration and attention. When in Canada in 1894 I saw, as a passing traveller, some of the means which they took for handling their grain, and I can assure you that the system they have adopted there effects such a saving in time, labour, and expense generally as to provide a handsome profit to the grower of the grain and to the merchant who buys it. By the use

of elevators the grain is handled in the most rapid and economical method; and until such a system is introduced here, we can never hope to compete with those countries that already have it. It may be said then, Why has not the Government done something in this way? That is a very pertinent question; but before introducing such a system it is first of all necessary to secure the co-operation of the grain-growers themselves. When the grain-growers are seized of the necessity of the economy, and they combine to express their desire to have it, I do not think the Minister for Railways will stand in the way of the introduction of the system. The initial work rests largely with the farmer. On the occasion already referred to, I made a rough estimate of the number of times that the bag of maize has to be handled from the time it leaves the farm till it reaches the consumer—say at Charters Towers. If you count the number of times a bag has to be stacked here and stacked there, perhaps fifteen or twenty times will be few enough. That adds to the cost of the maize, and that cost must come off the profit of the man who grows it. Until the grower realises this loss, he will continue to lose what would be to him a very liberal and wide profit. A rough explanation of the system which is adopted in Canada and similar countries may be given. In the first place, the question of bags is non-existent. They are not used at all in the handling of grain. The sack question was a few years ago, and perhaps still is, a burning one among our farmers. The Canadian grain-growers have inexpensive lifts for their own barns. They can be put up for about from £7 10s. to £10, and they save the whole of the labour of handling, and very often they are worked by the ordinary horse-power. The grain is dumped into a trough from which it is carried by a simple machine up to a bin on an upper floor. When it is desired to send it out, a trapdoor floods it into wagons, which carry it to the railroad platform. Trucks are run underneath the platform, and receive the grain in shoots. The grain is then carried to an elevator, the doors of the trucks are opened, and the grain pours in. It is then cleaned, graded, and put into bins. If it has to be shipped, it flows from the elevator into the ship. From the ship it is pumped out like water. I do not think I am far out in saying that the waste of energy in our own system is equal to a loss of from 3d. to 6d. per bushel. If we could devise some means by which a portion of this could be saved, then the association of farmers for common and mutual objects cannot be entirely without some result. I am speaking on this subject, because it is one which is rather misunderstood in Australia, and because the prospects of our ever becoming a large grain-growing country depend greatly on our adopting such an economic and time and labour saving system, in order to hold our own against countries which already have these advantages to aid them. In this connection it may be mentioned that in 1891 a commission was sent from Victoria to America to inquire into the methods of grain-growing there. I only saw their report the other day, but I was very pleased to see in it that very many crude ideas of my own were confirmed and enlarged by the careful inquiry that had been made. In the States I may say that the cost of cleaning grain thoroughly from all impurities, grading it into the different classes, weighing and loading it into ship or other railway train does not cost more than between ¼d. and ½d. per bushel. I was under the impression that the cost was lower, as I had been told at Fort William that it was only ⅛d. per bushel, but in the report of the commission it is put slightly higher. Even if it were 1d. per bushel, what an enormous saving such a system would make to our people.

The high cost of machinery in Queensland is another subject. I have investigated this matter a good deal, and may say at once, without wishing to make any special complaint, that it is a matter resting entirely with the farmers themselves. In the States the reaper and binder, which the Australian farmer has to pay from £55 to £65 apiece for, costs about £18. I am taking that figure from the report I mentioned previously. From my own experience, in isolated cases, I know that by taking the proper steps farmers can obtain machinery for themselves at very much less cost than they have to pay now. Of course, I do not blame the machine men so much. They have to import

quantities of machinery, a large amount of which becomes useless and unsaleable by going out of fashion. But the loss on this old stock finally comes back on the agriculturist, and he could, by combining and by using a little business forethought, get his machinery at a much less cost than at present. I speak of this because I think the time has come when there ought to be a better spirit of mutual help and co-operation among the different farmers. I give you this as an illustration of one of the directions in which combination would be of very great benefit.

There is a third subject. But, first of all, I would like to express the satisfaction with which we have seen the returns which were received in respect of our last shipment of butter from this colony to England. I think we have very great reason to be proud of the result of that shipment. I hope the fact that we have succeeded in getting such a high price for our butter will encourage us to endeavour to go on and keep up the supply in future. We cannot, however, hope to successfully compete with other countries until we make up our minds to avail ourselves of the economy and improvements with which they have been working, and one of the first of these is the selection of suitable dairy cattle. I know that what I am now going to speak of is a debatable subject among stock-raisers; but probably a greater blunder cannot be made by our farmers—and it is one that is being continually made—than that of using crossbred or mongrel bulls. I remember at a Queensland show, telling the people that I had seen cattle exhibited under description of breeds which I could not recognise in the slightest way as belonging to those breeds. In fact, wherever you go in this country you will find in shows animals entered which have no right to be competing in the classes where they appear. You see crossbreds, and you know that from crossbreds you can never count upon anything like certainty in their progeny. I have seen upon farms, animals the owners of which were proud to have at the head of their herds—animals which ought not to be allowed to exist at all. In truth, until there is some combination among the dairy farmers of this country, and a determination on their part to improve the breed of cattle, the colony can never be able to take that position in the export of dairy produce to which it is entitled. This reminds me of the small herd of pure-bred Ayrshire cattle which have just been introduced for the use of the College, and of the pure-bred Ayrshire bulls which have also been imported from Victoria for disposal among our principal dairying districts by competition for the best exhibits of dairy cattle, under test. I may explain why this particular breed was selected for this purpose. Of course, the Jersey, Ayrshire, and Holstein have proved themselves three of the most valuable dairying breeds for Australia. The milking strain of the Shorthorn, I know, is advocated by many. However, I think I shall be borne out when I say that by crossing Jersey bulls with ordinary cows you do not improve the quantity of the milk, but you improve the quality very materially. This at least has been my experience; and so it occurred to me that the best line to go upon first was the introduction of a breed which was well known for its large milking qualities. This, I thought, would be best effected by the use of Ayrshires. When we have increased the yield of milk in our cows, we can perhaps think of improving its quality by the use of another breed.

I have mentioned a few of the subjects in which farmers can materially help themselves. The instruction, however, will not be all from one side, and one of the great hopes I have from this Conference, from the discussions that will ensue, and from the views that will be expressed, is that not only myself, but the country generally, may learn in what direction the agricultural thought is trending, and what assistance can be granted to it. So far as the Parliament and Government are concerned, I believe there is a sincere and hearty desire to do everything that can be done to promote the agricultural interest. It has fallen upon me to hold the active administration of the Agricultural Department, and in this to give action to the wishes of Parliament and Government, and I hope that from this Conference we will be able to get the material by which further to promote the interests of agriculture. I feel sure

that anything that is feasible will receive most careful consideration from everyone connected with the Department. Many think that the field of the operations of the Department should be very much wider than we propose extending them. My idea of the functions of the Department is that in the first place we should be able to give every agriculturist in this colony useful information upon any subject bearing upon his business upon which inquiry is made. It is for this purpose that we have already secured the services of specialists, who need no recommendation from me. I do, however, hope to see additional specialists added to our staff. In this great question of agricultural education, which you now see exemplified in the establishment of this institution, in the carrying on of experiments which cannot be effectively made by private individuals, or even if they can be made, cannot be communicated to others with the same facility with which similar experiments carried on by, or under the supervision of, the Department can be, and in the promotion of combined action to promote common interests in these and other matters you will find the officers of the Department always ready to join and assist in every way in their power. If they were not to do so they would not be performing the duty they owed to the country. I do not think, however, there will be much cause for complaint in this respect. In fact, I sometimes fear that the Department may go too fast for the conservative character which has always been attributed to the agricultural class the world over.

In conclusion, gentlemen, I may say that personally I feel very flattered and proud that you have responded to our invitation. I trust that our mutual intercourse will be productive not merely of substantial good for the agricultural industry of Queensland, but that it may promote feelings of fellowship and kinship, and a unity of interest among the farmers of Queensland in the East and the West, the North and the South, so that in the future they may be able to have some means of understanding clearly and distinctly the aims and wishes of the different classes of farmers all over the colony, and that they may be able to make their voices heard and their wishes and wants known, so that those who desire to assist them may be able to do so in a helpful and practical manner.

GENERAL BUSINESS.

Mr. Thynne then informed the meeting that it was proposed, at the conclusion of the Conference on the forenoon of the 12th instant, in order to give those delegates who desired it an opportunity of visiting the Darling Downs, that they should be taken by train to Toowoomba in the afternoon of that day, and after tea go on to Warwick by special train. They would sleep there, and proceed on the morning of the 13th to Killarney, and on the way inspect the recently established State farm at the Hermitage, returning to Brisbane the same evening at half-past 10.

Mr. Lely (Ingham) congratulated and thanked the Minister and his Department for the splendid arrangements that had been made for the benefit of the delegates. The trip to Killarney and the Downs would give many of the delegates their first opportunity of seeing this celebrated country, and, consequently, besides being enjoyable, it could not be otherwise than instructive to them. There was certainly philosophy in doing and seeing as much as they could.

On the suggestion of Mr. P. McLean, Under Secretary for Agriculture, Messrs. Lely, Denman, Whiteley, Wells, Wilson, and Hoggan were appointed a committee to bring up recommendations for discussion at future sessions.

Mr. Hoggan was appointed convener of the committee. The session then adjourned.

SECOND SESSION.

On resuming business at 2·15 p.m., Mr. Thynne announced that he had been requested, on behalf of some of the delegates who were interested in sugar cultivation, to say that all such gentlemen were invited to meet in the secretary's room at 7 a.m. on the following morning. The recommendation

committee had also suggested that a question-box be provided, into which delegates who wished for information on any particular subject could deposit their written questions. It was thought this would be a very useful way of disseminating information on minor subjects. Mr. Thynne also stated that the chairman of the Recommendations Committee would read out the proposed resolutions to the Conference a session or two before it was proposed to discuss them. This would give delegates time to give some little consideration to the proposed resolutions.

Mr. HOGGAN, on behalf of the committee, then read out certain resolutions which it was intended should be discussed at a future sitting.

Mr. G. STUCKEY (Maryborough) then read a paper on "Notes on Farming in the Wide Bay and Burnett District," in which he dealt shortly with the description of farm lands in those districts, and explained how farming operations should be conducted on scrub lands, and what were the most profitable crops to grow. He recommended summer fallowing, and advised farmers to combine dairying and grazing with farming. He also supplied valuable information as to the land available for selection in the district.

At the conclusion of his paper, Mr. STUCKEY expressed his pleasure at being present at the Conference—representative, as it was, of the bone and sinew of the colony. The place where the Conference was being held also gratified him. The College was only the beginning. The end would only be seen by their children.

Mr. MOULDAY (Allora) initiated an animated discussion, during which Mr. STUCKEY described fully the method of draining as carried out by him, and its effect upon lucerne and other crops.

Mr. P. MCLEAN remarked that the scrub of the Wide Bay district was very light compared with that of some other localities.

In reply to a question by Mr. Hoggan (Stanthorpe), Mr. MCLEAN said Peccan nuts had been distributed by the Agricultural Department all over the colony, and in many cases the young trees were doing remarkably well.

Mr. WHITELEY (Rockhampton) said some trees of the Peccan nut were growing well in the Rockhampton district. Speaking on fallowing, as recommended by Mr. Stuckey, he said the summer months were too hot in the tropics for the land to lie fallow.

Mr. STUCKEY said his own farming experience in Queensland was confined to the Wide Bay district. He had found fallowing in the summer months advantageous. On one occasion land so treated had given him 7 tons of hay to the acre. Land alongside, not fallowed, had given comparatively a poor crop.

In conclusion, the CHAIRMAN said they had had a very interesting paper from Mr. Stuckey, which had provoked a most useful discussion. Mr. Stuckey had given his experiences as a farmer, and they could not be without some lessons applicable to many of the farmers present.

Mr. E. DENMAN, of Mackay, then read a paper on

"THE SUGAR INDUSTRY AND ITS REQUIREMENTS."

AFTER a few preparatory remarks conveying a friendly greeting from the Northern to the Southern farmers, he said:—

The interests of the cane farmers in the North and the general farmer in the South are identical.

We have to-day three things which the Pioneer River Farmers' Association have long desired to see—viz., a representative Conference, an Agricultural College, and a Minister for Agriculture. The farming community has good cause to rejoice that their interests are in the keeping of a gentleman whose heart is in his work, whose sympathies are with the farmers, and whose chief aim and ambition, I am sure, is to lift agriculture to the high position it should hold in commerce, in society, and in politics.

Very few are aware of the magnitude of the sugar industry, of its importance to the colony, or of the vast sum that has been invested in it. From the report of the Sugar Commission it would be seen that between four and five millions pounds sterling have been invested in it, and that the annual disbursement exceeds £800,000.

The price of sugar and the cost of production have now met, and something must be done, and done quickly, to prevent the extinction of the industry and the destitution and desolation which must inevitably follow.

The greatest aim of a true Statesman should be to settle people on the land, and any industry which assists to do this successfully is worthy of great consideration. Look at the great sacrifice Germany makes in this respect; look at the immense sum she pays annually in bounties on beet sugar! Does she do this to supply England with cheap sugar? No. Her object is to keep her fighting men on the land, and to do this the people of Germany have to pay 5d. per lb. for the same sugar that is sold in England at 1½d. per lb.

There are at the present moment 20,000 people actually dependent on the sugar industry of this colony. It provides a vast amount of work for the foundries in Townsville, Bundaberg, Maryborough, and Brisbane, and also affords a good market for maize and other feed stuffs, and for general farm produce. From authoritative sources I find that in one year Mackay alone imported 1,500 tons of maize, 498 tons of potatoes, 104 tons of chaff, 70 tons of green fruit, 95 tons of pollard, and many other products of the south in large quantities, and at the present moment, on a single estate, 800 horses brought from South Queensland are being fed on southern maize. One auctioneer in Mackay disposed of 1,030 southern horses in one year. I merely mention these facts to show the far-reaching benefits of the sugar industry.

Now let us see if that industry has assisted settlement. I think it has done so in a greater degree and more successfully than any other industry. As my object is not simply to make statements, but to adduce facts to support any statement I may make, I will try and do so by illustration, taking four selections conterminous with my own.

After I took up my selection I had to wait eleven years for the erection of a mill before I could grow any cane. In the interim I and my neighbours grew maize, and not only supplied Mackay wants, but exported to most of the inland and coast towns of the North, thus competing with Southern farmers in a branch of agriculture peculiarly their own. In time, mills were erected on three of these selections, each of which in a single year consumed 1,000 bags of maize. Whilst engaged in maize-growing, the only persons on the land were either the selector or his bailiff and from two to five Kanakas. Now, let us see the change wrought by the erection of mills and the advent of cane-growing. Mr. Paget says (*vide* Sugar Report)—"£60,000 has been expended, which last year returned no interest. The wages paid to Europeans amounted to £2,113 12s. 8d.; to Kanakas, £995 13s. 8d." Mr. Robertson (Habana) says: "We have invested £62,686, and we paid in wages to Europeans £2,488; to Kanakas, £2,377." Mr. Boulton says: "Including Foulden, we have invested £151,699 13s. 7d. We paid in wages to Europeans, £2,935 10s. 1d.; to Kanakas, £1,756 14s. 6d.

To these sums must be added rations for both Europeans and Kanakas, and even then we do not arrive at the actual disbursement on these estates. I do not think anyone will attempt to deny that the expenditure of these large sums benefited not only the district but the colony also.

I particularise these mills for several reasons. They are on what are known as "scrub estates," on which most of the work is done by hand labour, and consequently the ratio of Kanaka wages to those of Europeans is much larger than on other estates.

I will now illustrate what the closing of a single sugar estate means to a locality, and what the loss of the industry would mean to North-eastern Queensland. On the occasion of a lady friend leaving the Mackay district I drove her to a friend's house, and our route lay through eight miles of cane-

fields, with only one small break in the shape of a small township. Only last month, on her revisiting the district, I again performed the same journey with her. The change she saw drew from her the remark: "What a change! What desolation!" Now, what was the change? Along the whole route there was not a vestige of cane or of any other cultivation, and the township was almost deserted; a few cattle roamed over the abandoned canefields. A portion of the land referred to is the River Estate. In his evidence before the Sugar Commission the late manager of the estate said that £129,685 13s. 1d. was invested in the property. The working expenses in 1888 were £15,000 per annum. The wages to Europeans amounted to £3,702 1s. 10d., to Kanakas £1,460; European rations, £718; Kanaka rations, £1,751. This estate fed 100 horses daily.

I have pictured the desolation caused by the closing of a single estate; but who can say what would be the distress and destitution which must have overtaken some of the large number of citizens and labourers who formerly received this large sum in wages?

You may be interested in a few figures concerning a modern sugar estate; so I will take Homebush, formerly a cattle station employing two white men and a few aboriginals. The Colonial Sugar-Refining Company bought it, and converted it into a sugar plantation, and obtained certain concessions on the understanding that they expended £250,000. This the company did, and at one time were paying as much as £1,000 a month in wages.

At present this estate is held by farmers under purchasing leases to grow cane. Now, let us analyse these figures—

170 white farmers settled on the land.
100 white men constantly employed by them.
120 extra men during the six months' cutting season.
120 extra men in the mill, and white cane-cutters earning from £2,000 to £3,000 during the season.

Then we have—

7,000 tons of freight for coastal steamers.
7,000 " " teamsters and railways.
7,000 " sugar for wharf labourers to handle three times.
7,000 tons for the refineries in Brisbane and Bundaberg.
Nearly 1,000 tons of Southern maize shipped, handled, and consumed on the estate; and, including contractors, 700 white men and 400 kanakas to consume Southern produce.

Surely, gentlemen, this is a very desirable change; and yet I tell you honestly that were those 400 Kanakas taken away, this gigantic co-operative plantation would collapse, and, still, not a session passes without someone tabling a motion for the abolition of this labour. Gentlemen, you can and will, I trust, assist in making this suicidal policy impossible.

The Government of Queensland advanced £50,000 to the farmers to enable them to erect mills and do without this class of labour. The attempt, honestly made, was a failure; and the restrictions, as far as they applied to field labour by Kanakas, had to be rescinded. The opinion of all those who have visited the sugar districts, and have seen for themselves, is that Kanaka labour is an absolute necessity.

Many think that labour-saving machinery may be invented to obviate the necessity for this class of labour. During my thirty-three years' experience of cane cultivation I have heard many devout wishes expressed on this point, but I fear we are no nearer the production of such machinery than we were in 1864. The cane farmer would hail it with joy. We do not employ coloured labour because we like it, but because it is an absolute necessity. Still, the members of the Pioneer River Farmers' Association, whilst in favour of Kanaka labour, are decidedly averse to Asiatic labour of any kind.

I see that the total output of gold in Queensland for thirty-eight years has reached 12,000,000 oz., worth about £40,000,000. These figures would make gold-mining appear to overshadow every other industry. But let us

reduce these imposing figures to something comprehensible and understood by most of us—let us reduce the ounces to tons—12,000,000 oz. is not quite 300 tons, so that the first thing that strikes us is that the whole of the gold produced in Queensland would not provide half-a-cargo for the smallest steamer on our coast for one trip, nor would it give more than a day's employment to the wharf labourers. I am not in a position to give the total output of sugar in Queensland, but, thanks to the *Sugar Journal*, I can do so for ten years, the figures being from official sources. The total output of sugar for those ten years (some of them exceedingly bad ones) was 630,000 tons, with 1,300,000 gallons of rum and 10,000,000 gallons of molasses—the whole worth at least £10,000,000. Surely these figures will prove that as a provider of work the sugar industry has no peer, and I wish to point out particularly that, whereas the gold figures extend over thirty years, the sugar figures are confined to ten only. Queensland has produced £40,000,000 worth of gold, but her goldfields are the poorer by that amount. The sugar-fields, which in ten years have produced £10,000,000 worth of sugar, could and would with fair treatment produce £20,000,000 in the next ten years; and I make this statement with some knowledge of the capabilities of land, having served my apprenticeship upon an estate where cane had been grown continuously for 200 years.

It was at one time thought that fruit-growing would replace cane cultivation, but, as a large fruit-grower at one time, my experience is that when sugar-growing flourished fruit-growing prospered, but I am certain that fruit-growing and all other subsidiary industries together will never approach sugar in importance. Now, gentlemen, although I am here as the representative of a sugar district, my thoughts are not so wrapped up in that industry, important as it is, that I cannot extend my sympathies to anyone outside it. The Pioneer River Farmers' Association can and does extend its sympathies to brother farmers in the South in the terrible losses they in common with us experienced from drought and flood. Our sympathies extend to agriculture generally, and it is our great aim to see agriculture raised to the high and important position it should hold, and I do hope that we shall now make such suggestions that the Minister for Agriculture will, from our rough-hewn ideas, be able to perfect such measures as will help to free the farmers from some of the difficulties inseparable from their calling.

The possibilities of agriculture are great. Look at Chicago! What built that city? Her grain elevators—her splendid buildings—her immense packing industries? It was agriculture; and it is agriculture which should build our cities, our railways, and our harbours.

In conclusion, I think the cause of agriculture would be greatly assisted if a somewhat higher education could be had at the College without the necessity of sending country lads to the cities to obtain it. There they acquire city habits and city ideas. When they return home a farming life is distasteful to them. They cannot take to it, and yet every avenue to city life for which they may be fitted is hopelessly overcrowded. Agriculture as a profession is in Queensland capable of vast improvement, and we have in this College to-day a token that the head of this Department thinks so. We have, in this assembly of delegates from all parts of Queensland, unmistakable evidence that the farmers think so themselves.

We expect much, and I am sure we shall not be disappointed, from the Minister for Agriculture. He, too, has a right to expect something from us. He has asked us to give him our sympathy and support, and I trust all here will do so, not only in their own interests but in the best interests of the most ancient, the most honourable, but, I regret to say, at present the most depressed, of all professions—Agriculture.

In reply to a question of Mr. Moulday's (Allora), Mr. Denman said they could not successfully grow sugar without black labour. That was his opinion after thirty-three years' experience. A friend of his (Mr.

Pearce), to whom the farmers of Queensland owed the erection of the first central sugar-mill, had differed from him on this point, and had tried to grow sugar with white labour. He failed, however.

Mr. THYNNE having suggested that perhaps Mr. Denman might go further into the details of the failure of white labour to do this work,

Mr. DENMAN instanced the Mackay central sugar-mills. These were originally under an obligation only to use cane that had been grown by white labour. They had tried to do so, but if the Government had not withdrawn the prohibition they would have had to have thrown up the business. The furthest they have got is to have white labour only within the mill. He then mentioned the cases of white contractors cutting cane, but refusing to load it. They should always remember this: Cane once cut had to be crushed within twenty-four hours. It was not like wheat; and if men refused to handle it, it was spoilt. In fact, the only work white men will do in the canefield in the North was the cutting. They had advertised for men for other work, but could never get any to agree to do it.

Mr. O'KEEFE (Laidley) here remarked that he believed there was a prevailing notion that white men would not do the work because the wages were not good enough.

In reply to this, Mr. SWAYNE (Mackay) read extracts from a report of a sugar company's inspector at Mackay, and gave instances of the actual wages earned by European cane-cutters in the North. Throughout one season two gangs earned 25s. 6d. per week per man after paying for rations. New hands had earned at the rate of 18s. 3d. per week clear of ration money and another shilling for extras. These were new hands. Older hands on a similar job earned 25s. per week clear of everything, and others made up to as much as £2 per week.

Mr. SWAYNE pointed out that many of the mills in his district would require 400 tons of cane every twenty-four hours. Every stoppage that occurred had to come out of the cost of the cane. Again, with the exception of butter, sugar was the only agricultural product of Queensland that had to compete in the world's markets. The price of sugar in this country was ruled by Java, and Java was probably ruled by Europe. The prices paid by their competitors for field labour would be interesting. In the figures given, the men had to find themselves in everything, including food. Europe (beet sugar)—Men, 2s. per day; women, 1s. per day; harvesting done by machinery at a cost of 6s. per acre. Demerara and West Indies—Coolie labour, at 10d. to 1s. 4d. per day. Fiji—Kanakas, at 50 per cent. less cost than in Queensland. Tahiti—Coolies, 9d. per day. Java and Philippines—5d. to 8d. per day. Straits Settlements—Coolies, 5d. per day. Mauritius—6d. per day. Reunion—1s. 3d. per day. Egypt—7½d. per day. In Queensland the Kanaka costs the farmer 2s. 6d. per day.

Mr. THYNNE said the subject was to a certain extent a delicate one, and he trusted the discussion on it would keep clear of party politics. Personally, he would be very sorry if it appeared he had encouraged the utilisation of the Conference for a political purpose. So long, however, as they kept clear of party politics he thought the members of the Conference were quite within their rights in expressing their opinion on matters of State policy which affected their interests. Mr. Denman's paper had brought before them, from his particular point of view, many of the difficulties the sugar-planters of the North had to contend with. The whole of the matter resolved itself into two questions—whether white men could do the work necessary in the production of cane for the mill, and, if so, would they do it? Mr. Swayne had said he considered they could do the work. Then came the question, Were they willing to do it? This introduced a third question. Were they offered a fair price for doing it? They had a statement from Mr. Swayne to the effect that men could earn from 18s. to 25s. 6d. per week clear of rations and quarters. They could then ask themselves if the work deserved a higher rate of wages, and, if so, could the sugar industry afford it? The whole matter, he thought, appeared to resolve itself into these questions.

Mr. T. Whiteley said they had been told that the price of sugar had reached such a stage that if something was not done for the industry it was in danger of collapsing. If this were so, the Northern farmers would have to look to other crops. Mr. Denman had said that fruit had been tried, but had not been a commercial success. There were, however, other crops, such as coffee, tea, manilla, which might be tried, and which would perhaps be able to somewhat relieve the sugar industry. With regard to the labour question, it appeared that it depended on outside countries where labour was cheap, and the matter then resolved itself into what the industry could afford to pay. If this were so he was inclined to think it would perhaps be better to let the industry go. Of course that was his own opinion.

Mr. Denman said the cultivation of coffee would bring them still further into the labour difficulty. Coffee would require more cheap labour than sugar. The chief present trouble of planters was the low price of sugar. If all the Kanakas in the Mackay district were taken away the industry would collapse. All the small cane planters employed Kanakas. He generally had about four himself. One of the great advantages of the Kanaka was his reliability, which was quite of equal importance to cost.

Mr. McLean instanced the case of the Mackay central mills, which were established to assist the production of cane by European labour. Financially the mills had been a success, but the agreement that they should only use cane grown by white labour had never been kept. Shortly after they started, three-fourths of the cane that went through them were produced by black labour.

Mr. Deacon (Allora) said many people were afraid coloured labour was never going to cease in the North. Were Asiatics to be employed when the supply of Kanakas became exhausted?

Mr. Denman said the Kanakas would last out their time.

Mr. Deacon, continuing, said the question of the reliability of white labour was one the Downs farmers had also to deal with. They were always troubled with men at the busy seasons who wanted wages and not work. Only recently he had offered two men, who were doing nothing, 4s. a day and rations, but it was refused.

Mr. Lely reminded those present that theirs was a large colony, with very different conditions, and if they were all to progress as agriculturists it must be by a certain amount of mutual giving and taking. The black labour question was, perhaps unfortunately, a political one. It was, however, a question of livelihood to many of them. He might first inform them the law relating to the illegal employment of Kanakas was enforced by the Northern farmers. He then asked, Was the South going to participate in the benefits of the sugar industry by encouraging its development in the North, or were they going to extinguish it? The only way in which the South could assist the North was to allow it to grow cane in a manner that would enable them to compete with other sugar-producing countries. If the South were blind enough to stop this, the blow would fall on the North, but the South would feel it almost as quickly. The Kanaka question was one of economy. It was also one of reliability. Every planter must have a staff of reliable labour. Unless he can keep this labour, he cannot carry on his occupation as a sugar-grower, and at the present price of sugar it was impossible to pay white labour wages which would be remunerative to both employer and labourer. As it was, they were handicapped by having to pay 2s. 6d. a day for their cheap labour. If they were to open up the North they must have cheap reliable and acclimatised labour.

Mr. O'Keefe (Laidley) said the question appeared to be one of pounds, shillings, and pence. The North, however, was the only part of the colony which got the benefit of this cheap labour. He asked: Could maize be grown by white men at present prices in the North? The Southern maize-grower could get no assistance in the shape of coloured labour.

Mr. Denman said the difficulty with cane was that all work in connection with its cultivation and harvesting had to be done by hand. They had never been able to get any suitable machinery for the work. This was where cane differed from maize, wheat, and many other crops.

In reply to a question of Mr. Moulday, Mr. Denman said sugar could not be grown profitably in the North without black labour.

Mr. Noakes (Bundaberg) furnished some information on the subject. Every islander landed cost the planter at least £30. He formerly used to employ ninety boys, but he had now leased all his land to farmers to grow cane, and had found this arrangement the most satisfactory. All these small farmers, however, employed Kanakas.

The discussion then closed, and the delegates left the room to inspect the College silo, which had just been opened.

The ensilage was, in the presence of the delegates, fed to the stock in troughs, and the eagerness with which they ate it, even from the hands of the visitors, was a sufficient testimony to its excellence.

THIRD SESSION.

Thursday Evening, 7·30 p.m., 10th June.

Mr. Lely said he had a small explanation to make. His district had arranged to be represented at the Conference by the Hon. A. S. Cowley and himself, but circumstances had prevented the former gentleman from attending. Mr. Cowley had, however, handed to him a paper on sugar bounties, and had asked him to read it at the Conference. With the permission of the President he would do so.

The paper, which, according to Mr. Lely, represented the consensus of opinion of the sugar-growers of the Herbert River district, was as follows:—

The West Indian sugar-planters are in dire trouble, and for those of Queensland, trouble is looming in the distance, for we have glutted the Australian market, and will have shortly to compete in that of London with the cheap continental sugars; while every season the supply of labour becomes scarcer than before. It is not my intention to deal at present with this latter difficulty, but to lay before you the suggestions of English economists with regard to the ruinous competition we meet with in the London market in connection with the bounty-fed German, French, and Austrian sugars; and these bounties are so high that the German manufacturer can actually sell his sugar cheaper in England than he can in Germany. The proposal of Mr. Jager and other British economists who have taken up the case on behalf of the colonies is, in his own words, as follows:—"Let tea come in free to England and put a duty upon sugar coming from foreign countries to make up for the loss which the revenue would sustain by the withdrawal of the tax on tea. What can the freetrader say against this suggestion? To talk of freetrade while tea, which comes from our own colonies, is taxed, and sugar, which comes from foreign countries, is free, is absurd. At the time sugar was made a freetrade article, nearly all of it came from our colonies, while nearly all of our tea came from China. Now the situation is entirely reversed. All our tea practically comes from India and Ceylon, while all our sugar practically comes from foreign countries. Nobody would suffer by the change of taxation, as there are no industries based upon tea after it is imported into this country. If it did increase the consumption of tea, India and Ceylon would benefit by it, and at the same time the consumption of sugar would be increased, for the two go hand in hand. And further, if home-grown beet sugar were free from taxation, as well as our colonial sugar, the cultivation of beet would be fostered, to the great advantage of agriculture." After the proposal I have just quoted was published in England, a further suggestion was made that coffee and cocoa, both in the main produced in British colonies, should also be placed upon the free list, and it is to the proposal that England be asked to admit tea, coffee, and cocoa free and

to tax sugar from foreign countries that I invite your support. Were the duty removed from tea, coffee, and cocoa, and a tax to produce a like sum to that now yielded by such duty placed upon foreign sugar, it is quite certain the English people and the English Government would be none the poorer; but I think I shall be able to show you that the purchasing power of the poorest classes, to provide whom with a free breakfast table, which is the constant aim of the freetrader, would be increased. The consumption of tea may be said to be general in England. All that is used is purchased by each consuming family in what I may call its plantation condition, that is—as has been before mentioned, nothing is manufactured from it. The average annual consumption of sugar in England is 77 lb. per head, but of those 77 lb. only 14 lb. per head is used in its raw state by the family; the balance being employed in the manufacture of confectionery. Now, confectionery is a luxury not largely used by the poorest classes, so the effect of the proposed alteration would be that well-to-do people would pay a little more for their confectionery, while the poorest classes would pay less for their tea. Experts inform us that the increase in the cost of jam would be only half-a-farthing per lb. In submitting to you the advisableness of approaching Mr. Chamberlain, through our Government, on this subject, I would urge that it is one of Imperial importance, concerning as it does both England and the colonies; that it is a step in the direction of an Imperial Zolverein, and is certain of sympathetic consideration on the part of the statesman who so ably presides over the destinies of Greater Britain.

After reading the paper, Mr. Lely suggested that the Queensland Government cable to Sir Hugh Nelson the result of their deliberations on this subject. Such a cablegram would strengthen his hands. He had already been written to on the matter.

Mr. Thynne said the paper Mr. Lely had been kind enough to read had come rather unexpectedly, and he doubted whether any of those present were in a position to discuss it immediately. The subject was a very important one, and he suggested that it be dealt with at a future sitting. The paper was then referred to the Recommendations Committee.

CLIMATIC DIFFICULTIES, PESTS AND BLIGHTS IN NORTHERN CANEFIELDS.

Mr. J. Lely (Ingham) said he had unfortunately been unable to prepare the paper set down for him, but with their permission he would be glad to make a few impromtu remarks on the above subject. First came the question of climatic difficulties. There was a sort of notion prevailing among many Southerners that those who lived in the North were well off in many respects, but he would like to give them a slight idea of many of the difficulties they had to contend against. It was very easy to acquire land certainly, but the chief difficulty they had to contend with was the climate. The malaria was always around them. What the ultimate result of the Northern climate on Europeans would be he could not say. In India, it was known, people of European origin died out in three generations, and it was not unlikely the same thing would take place in our tropic North, unless a mode of life were adopted which would counteract the influences of the climate. Of course, in the North of Queensland they had easy access to a milder climate by getting on to the Herberton tableland. This climatic condition was at the bottom of the necessity for having a staff of labour which would not be affected by the malaria arising from the soil. The South Sea Islander, and those native born to such a climate, were not affected by it. They retained their health in places where the white man was bound to succumb, and the white labourer knew it. He could not stand the work during the hot season. The Herbert River, where he (Mr. Lely) lived, was a paradise compared with some of the Northern districts, but he remembered when the Herbert was a den of fever. But they had got over that, and for many reasons the

climate had vastly improved, although the malaria was still in the soil.* Another phase of the climate was the rainfall. They had cyclones, dry seasons and excessively wet ones, and floods. Then they had excessively dry seasons, occurring often in May, the month they relied on during which to plant the cane, and the result is the loss of a year. Then came exceedingly wet seasons, which, again, had to be subdivided into exceedingly wet and exceedingly *wet* wet seasons. The second kind of season mentioned was so serious in its effects that the planting of cane often did not take place till the following October. These, of course, were exceptional seasons, but still they were not of unfrequent occurrence. Then came the question of blights. They were not troubled much with gumming in the North, although it existed. Then there was a disease which might be called blighted stooling, which appeared to arise from an unhealthy condition of the roots. The diseased cane would send up stools which would never come to anything. Rust was a formidable disease, but fortunately of late years they had not been troubled with it. Eighteen years ago it had destroyed nearly all the cane on the river, the varieties in vogue then being the Bourbon† and the Salangore. The planters then tried the Cheribon, but this was found to be a difficult cane for manufacture, and it had ultimately to be abandoned. Mauritius Gingham, Striped Singapore, and Rappoe were now among the standard varieties in his district. Rot was their next trouble. When attacked by this disease the heart of the cane would turn yellow, and if they examined it closely they would detect the presence of a small worm. This disease was chiefly prevalent in good seasons, and attacked plant cane more than ratoons. The disease was infectious, and was so serious that it was compelling them to abandon some of their best varieties. It was not unlikely due to enfeebled constitution. A cane would perhaps be healthy enough, but when its development was forced, through the agency of a good season, it became a victim to the disease. The New Guinea canes had so far been proof against it, as had also the White Bamboo, Moore's Purple, and Daniel Dupont. Among cane pests were the borer, the locust, the grasshopper, the caterpillar, the canegrub, and the waterhen. Mr. LELY described at considerable length the destructive operations of these pests. The planters ultimately combined to destroy the locusts, and, digging trenches, attacked them when in their crawling stage, drove them into the trenches and buried them. It cost them about £1,050 to do this, but since then there has been no resurrection of the locust to any extent, although it was still there. Floods also kept down this nuisance. The last pest he would refer to was the grub. This uninteresting looking "reptile" was the product of an egg that was laid by a beetle commonly known as the cockchafer. It emerges from the egg in February, if conditions are favourable, say a fortnight after its mother has deposited the egg. If, however, conditions were not favourable, the egg would perhaps remain in the ground till next season, when the grub would come out. He had personally known four months to elapse between the time when the egg was laid and the time when the grub emerged from it. This fact made the grub pest a difficult one to deal with. Immediately after hatching, the grub is about one-eighth of an inch long, but it grows rapidly, and when full grown averages about 2½ inches in length. The egg having been laid at the foot of a cane plant, the young grub begins to feed on the root of the cane stalk. It then goes through the process of destroying the roots, and finally, by working into the heart of the stalk, kills the whole cane. The unfortunate planter then had a good chance of seeing his crop ruined about two months before crushing. The cane generally showed the first indication of grub at the end of March. When the weather gets colder, and it has done its damage, the grub turns into a chrysalis, and lies dormant till the advent of the hot weather. It then turns

* By clearing and cultivation most districts formerly unhealthy become purified. Humpybong was abandoned as a settlement owing to the prevalence of fever and ague. To-day it is a health resort.—Ed. *Q.A.J.*

† The Bourbon cane, which often yielded 4 tons of sugar per acre, was the first to succumb to the rust, and Black Java was substituted in the South.—Ed. *Q.A.J.*

into a beetle, and flies away to reproduce more of its species. If the weather kept dry, however, it stayed in the ground, and this made the collection and subsequent destruction of them easier. It was owing to this last fact that they had been able to fairly satisfactorily cope with the pest on the Herbert the last couple of seasons. His own losses from it this season would only be a third of what they were a few years ago. They were thus making some headway against the grubs. In conclusion, Mr. Lely said he had mentioned some of the blights and pests Northern cane-growers had to contend with, but he could assure them that the unfavourable climatic conditions were a greater consideration with them than all the blights and pests put together, and they could therefore perhaps understand the desire for that kind of labour which was suitable for their climate. It should be remembered they were descended from people who had been brought up in temperate climates for thousands of years, and he might say if a white man were paid really what he should be paid, taking into consideration the injury to his constitution through work in the canefield, £1 a day would hardly recoup him.

Mr. Epps asked for particulars about Cheribon cane, but Mr. Thynne reminded him that few varieties had the same name in two different districts.

In reply, Mr. Lely said the objection made by manufacturers to Cheribon was that owing to the presence of a large amount of acid in it, clarification was rendered difficult. He did not wish to infer that it was a hard cane to crush.

In reply to another question of Mr. Epps, Mr. Lely said he had had no experience of bisulphide of carbon in the destruction of cane grubs, although he believed it had been used. He had tried, however, diluted ammonia. This would kill the grubs if sufficiently strong, and without prejudice to the cane.

Mr. T. Whiteley here remarked that he had tried this latter recipe for oranges, but had found it very expensive.

Mr. Lely said he considered all chemicals were expensive, even if it were only in the labour of applying them. They might do, however, for nurseries. The ammonia was applied at the root of the cane.

Mr. J. C. Brunnich said he had been one of the first in Queensland to make experiments with a view towards the destruction of the grub. He had also been one of the first to try the application of bisulphide of carbon for this purpose, although at first he had been hampered by not having the proper apparatus. However, he could now give them a good idea of what it would cost to apply this particular chemical; and it might be added that it was the only satisfactory remedy for the grubs. He had tried trenches, lime, sulphuric acid, chemicals, in fact everything that could be imagined. With the majority of chemicals, when they were strong enough to kill the grub, they were generally strong enough to kill the cane, and so far as lime was concerned it was harmless. Bisulphide of carbon, however, was a splendid destroyer of grubs, and if properly used could be applied with comparatively little labour and expense. When the leaves of cane begin to wither, the probability is grubs are the cause, and if a stool was knocked over the grubs, generally about fifteen of them would be found at the foot. A little bisulphide of carbon, applied with a force pump into the earth amongst them, would be sufficient to kill them all. The chemical, although extremely volatile, had the advantage in this case of being very heavy, and this resulted in its staying in the ground instead of rising out of it. A small quantity would kill all grubs within a radius of 2 feet of the place where it was injected. After the destruction of the grub by this means the roots of the cane would recover within the course of a couple of months, a network of roots at the foot of the stool would be formed, and the crop would be saved. This remedy could be effectively applied at a cost of about from £2 to £2 10s. per acre. Bisulphide of carbon was easily manufactured, and could probably be made on the spot. A good force pump was necessary for its application.

Mr. Lely thanked the last speaker for his information, and stated that if the grubs could be destroyed for £2 10s. an acre and the crop saved, the remedy was a practical one. It was not uncommon to soak cane plants in a

solution of some poison, but this Mr. Lely thought unnecessary, as it was in the soil the grubs were found. Frequent stirring of the ground, however, had a good effect in killing this pest. In conclusion, Mr. Lely referred to Mr. Tryon's pamphlet on grubs, and stated that some of the recommendations for the combatting of the pest therein advocated—namely, the systematic collection of the beetles and the destruction of the foliage harbouring them, coming from such a reliable authority as Mr. Tryon, had considerably strengthened the hands of those planters who had been hitherto adopting these methods..

Mr. HOGGAN mentioned Pyrethrum as a plant which might be tried in coping with insect pests. It was the basis of most insect powders, and it was said that wherever it was growing there was no insect life.

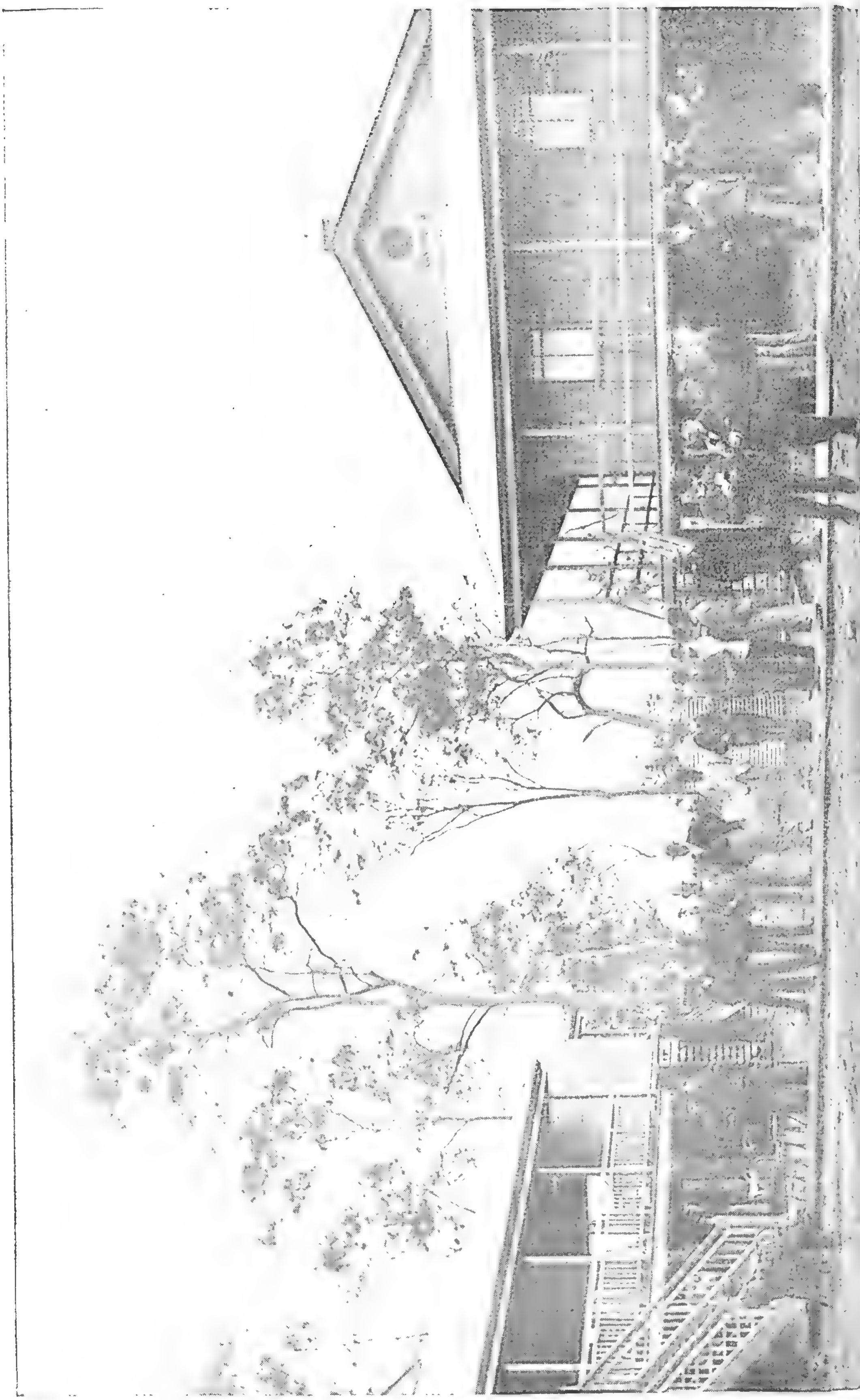
Mr. BOURKE also contributed to the discussion on Mr. Lely's remarks.

Mr. THYNNE pointed out that Mr. Lely had painted only the darker side of sugar-growing. He did not know, however, of any branch of agriculture in any part of the world which did not have its difficulties to contend with. In any event, if the agriculturists of any country were for a number of years in a position to carry on their calling without difficulties, they would soon have little grit and sustaining power left among them. It was difficulties that made men of them. They sympathised deeply with the Northern farmers in their troubles, but that sympathy was due because they knew in every part of the country the farmers had obstacles to overcome, perhaps not always of the same character, but equally puzzling and trying in connection with all our agricultural industries. Mr. Lely's address had, however, given and elicited much useful information; and he trusted that the Department's own experiments, the results of which would be published periodically, would be able to relieve many of the difficulties their friends in the sugar-growing districts had to contend with.

Mr. A. WATT (Beenleigh) then read his paper on—

SUB-DRAINAGE.

SUPPOSING an irrigation and a general drainage scheme adopted by Parliament, and the farmers to be told that they could not have both at once, but to choose which they would have first, would not they choose the drainage scheme? I think so. It seems very strange, in a climate such as ours—so liable to drought—that we hear so little about sub-drainage. The wonderful improvements which have been brought about by sub-draining in the old countries, in the easier working of the soil, in the retention of heat and moisture, and in increased yield, are evident to all experienced agriculturists. We are told that at the experimental farms in the south the soil retains moisture through the surface being kept loose. Every practical farmer knows that a loose surface makes a good mulch, but unless the land has natural drainage through a porous subsoil, or through one artificially drained, it will in a drought set hard and have but little loose surface. On the banks of our rivers and creeks we find, as a rule, deep porous soils, which, with frequent stirring with implement or hoe, will retain the moisture during a considerable drought, as will also the deep chocolate forest soils if kept frequently moved, but when the subsoil is a retentive clay it is a different matter. Now, we have considerable areas of good black soil, overlaying an impervious clay—what in Scotland would be called good wheat land—but owing to the clay subsoil the surface becomes waterlogged; the water, instead of sinking, evaporates slowly by the surface, and, especially in hot weather, fermentation sets in, sours the soil, it bakes and cracks in dry weather, and vegetation becomes miserable. Such land will stand neither drought nor wet; but drain it, and by the intelligent application of lime and good cultivation, that land will become mellow, free, and durable. The drains on the latter class of soil should not be more than 18 feet apart and 2½ to 3 feet in depth. Should the clay be within plough-furrow of the surface, the lesser depth will act best. Depth depends upon the nature of the subsoil and the outlet, but the further they are apart the deeper they should be, to draw the superabundant water



from the greater intervening space. Surface-drains or water furrows are very wasteful, as the valuable ingredients in the soil are carried off. We have instances of low-lying localities on tidal rivers and creeks where surface-drains can hardly be avoided, the land not being sufficiently elevated to admit of sub-drains, although, a good many years ago, some low-lying land on a sugar plantation on the Logan was sub-drained, and, to get a fall for the minor drains, the leaders or main drains had flood-gates put on to block the rising tides; those drains worked well, considering that they were blocked twice every twenty-four hours. It sometimes happens that, owing to the subsoil, you cannot avoid deep draining. Most of you have, no doubt, noticed land that required draining lying in plough-furrow or harrowed after a spell of wet weather; in the process of drying it presented a clouded appearance, patches remaining dark, others quickly drying and lighter in shade, showing sudden changes in the nature of the subsoil. I saw a considerable stretch of that class of land drained in Scotland. In testing the ground to fix the depth of the drains, we found the subsoil in the wet patches consisted of a stiffish, muddy-looking mass, intermixed with stones resembling chips of freestone of various sizes; the intervening patches or bands consisted of a sandy clay. It was thought, before testing the ground, that 3 feet would be a suitable depth, but it was found that in the stony, muddy-looking patches it would be difficult to bed the pipes. The wet ground was then tested for bottom, which was got at 4½ and 5 feet. It was, therefore, decided to put in the drains 5 feet deep and 1 chain apart; luckily, no leaders were required—each drain had an outlet into a burn or creek. That land had been drained before during a previous tenancy. The material used in the old drains was flagstones, which could be had in abundance on the sea-coast close by; they were rough-dressed and set into the drains in the form of an inverted V, the apex upwards. Now, unless well fitted and packed, you can easily understand that extra pressure on one side would cause the stones to shift, slip, or fall flat and choke the drain. That is what happened in this case; hence the necessity for being careful in such expensive work, in the setting and covering of the pipes, stones, or timber, as the case may be—so that the drains may be as permanent as possible. Pipes make the most efficient drains; but should long carriage make them too expensive, and should timber be plentiful and the subsoil clay or other firm substance, a good economical drain can be made of hardwood slabs, of a uniform width, and in from 3 to 4 feet lengths; lay one edge of the slab on the side of the drain, and lean the other edge on the opposite side, thus giving a triangular space for the water. Such drains last, and work well. It would not, however, be advisable to follow down steep slopes with this class of drain, as the action of the water would be injurious. Stones if convenient may be, and often are, used with good effect—the large stones on the bottom, the smaller on top. Subsoiling after draining is an additional protection against drought. A Scotch swing-plough makes a good subsoiler; take off the mould-board, and, if necessary to ease the resistance, reduce the wing of the share. Cattle-yard and stable manures or commercial fertilisers are useless; in fact, sometimes injurious to land that requires draining. In establishing an orchard, vegetable, or flower garden, disappointment may be avoided by an examination of the subsoil. A practical man can tell at a glance what is required to ensure success. Gardens have been laid out at considerable cost, and the one thing essential left out—viz., underground drainage. Some years ago I was told by a gentleman, who now owns one of the best gardens about Brisbane, that he had spent a lot of money on his garden, and was bitterly disappointed until he dropped on the right man in the person of a Scotch gardener, who told him the land required thorough draining. The gardener was allowed a free hand, and the result is now evident. I need hardly state that it costs less to put in the drains when you are preparing the land for fruit, &c., than either before or after. I have trenched forest land for fruit, and put in drains very

cheaply at the same time. I cleaned out each trench that suited the width the drains were to be apart; then dug out in drain fashion to the necessary depth. I used stones, getting sufficient for my purpose out of the land I was trenching. One reason for multiplying instances of the beneficial effects of draining is that many who have taken to farming in the colony, and especially our young men, have never had an opportunity of seeing draining carried out systematically. Nor are they likely to see it carried out to any extent by private enterprise. It is too costly. A Draining Act on the lines of the Imperial Draining Act should be adopted by Parliament; the money advanced by the Government on long and easy terms, on the recommendation of draining commissioners appointed for that purpose. The Act has worked well in the old countries; and why not here, where we are more liable to drought and floods? There is nothing like a good constitution to withstand disease; therefore give the soil a good constitution by draining and intelligent cultivation; then you may expect healthy plant life that will withstand many of the diseases and pests which now destroy the crops. The old adage "Like begets like" applies here as in everything else; an unhealthy soil cannot be expected to produce healthy vegetation. One more important advantage gained by draining is being able to work so soon after wet. There is nothing will make the farmer fret and worry more than weary waiting for undrained land to dry sufficiently and the season slipping past.

In reply to a question of Mr. Deacon,

Mr. Watt said it would not be necessary to drain land with a porous subsoil, or land with a subsoil 15 feet down, although drainage would improve any land.

In reply to questions from Messrs. Stephens, Noakes, and Bourke, Mr. Watt said it was of great consequence that the tiles be so laid that they could not shift. There was no necessity to make tests as to whether land wanted drainage or not. A practical man could easily see at a glance whether it was wanted or otherwise. For melon-hole country he would put the drains 18 feet apart, and have the drains $2\frac{1}{2}$ feet down. If artificial manures were put to sour land, they would make the land sourer still.

Mr. Stuckey explained how he prevented drains from shifting. He had special tools made and so arranged that if a pipe was loose he had it practically buried in the solid earth, so that it could not shift. It was a very safe way, and as far as the tools were concerned they could be made from old hoes.

Mr. Swayne said the Pioneer River Farmers' Association had been gathering information on the subject of drainage, and all they had got hitherto had gone to confirm Messrs. Watt's and Stuckey's statements. He believed a Drainage Act could be introduced into Queensland with very great advantage. Another matter on which legislation was required was riparian rights. So far as he knew, they had nothing of the kind in Queensland with the exception of a clause in the Divisional Boards Act. Individuals should have similar powers.

Mr. Lely endorsed Mr. Swayne's remarks. A thorough system of drainage, similar to systems that had been inaugurated by syndicates in other parts of the world, would be of great advantage in many districts of the colony. In Queensland, however, a syndicate would probably be beyond the question, and they would have to fall back on the Government. Such a draining system was out of the power of the small agriculturist, and, if they were to secure its advantages, it would have to be under some sort of State aid. The benefits of drainage were being shown in his own district, on the Victoria Plantation. The land was not bad, and was capable of producing good crops. Still, it was second-class and had a clay subsoil, but now its disadvantages were being obviated by the Colonial Sugar Refining Company, who had purchased a large drainage plant. They were now manufacturing on the plantation very superior drain-pipes, which were being laid through their lands at a depth of from $2\frac{1}{2}$ to 3 feet, and at intervals of half-a-chain apart. They were 3-inch and 2-inch pipes. The Company were laying these drains all through

their lessees' lands, and were charging only a very small sum for them. The beneficial effects of these drains had already become manifest. The Government might well inaugurate a similar system. At present the most expensive item to individual farmers in draining was the cost of freight on the pipes. Some soils did not require draining, but in the main, of course, all soils would be benefited by drainage.

Mr. O'Keefe agreed that drainage was a pressing question. In the Lockyer district it was forcing itself upon several, but unfortunately a farmer could not drain his land without generally interfering with his neighbours' properties, and it was thus a matter that could not be taken up by individuals. He doubted, too, whether it could be successfully undertaken by divisional boards, and trusted the subject would be brought up prominently before the Government.

Mr. Thynne said the clause in the Divisional Boards Act about drainage, which had been referred to, had originally been suggested to him by Mr. E. J. Stevens, and he (Mr. Thynne) had had it introduced into the Bill when it was passing through Parliament. The clause, however, had been simply introduced as an experiment, and, he believed, had so far practically remained a dead letter. The whole question was a very large one, and required much consideration. If those interested formulated a definite scheme in this matter, perhaps it might be possible to do something to assist them. Personally this subject of State co-operation in the matter of drainage had only been brought up before him within the last few months, and then the suggestions had only been of such a general character that he had been unable to prepare any definite proposal on the subject either for his colleagues or for Parliament. There were several other questions, he added, which were equally difficult to deal with for similar reasons.

Mr. Denman said that in 1846 £4,000,000 under the Scottish Drainage Act was voted by the Imperial Government for drainage purposes. With the exception of £9,000 all this had now been paid back. This showed that drainage was a profitable undertaking.

Mr. Lely said with such an example as that quoted by Mr. Denman, he thought the Queensland Government might well pass a similar Act here. Such an Act would be of immense assistance to agriculture. Money could be advanced to bodies of farmers to enable them to drain their lands. This principle of lending money to co-operative groups of farmers was in force in many parts of Germany and France, and was, in fact, the same as the present Central Sugar Mill system, which was now being started in Queensland. To make it a success, however, true co-operation among their farmers was absolutely necessary.

On the motion of Mr. Stephens, seconded by Mr. Noakes, it was then decided to refer this question of provision for drainage to the Recommendations Committee.

The Chairman then read apologies for non-attendance from Messrs. J. H. Davidson (of Wellington Point) and John Cameron (of the United Pastoralists' Association).

The Conference adjourned at 10 p.m.

FOURTH SESSION.

Friday Morning, 11th June, at 9 30 a.m.

Mr. J. C. Brünnich read the following paper on the

IMPORTANCE OF CHEMISTRY TO AGRICULTURE.

Professor Warington, in a lecture recently delivered before the University of Oxford, draws attention to the great difference in the position of agriculture at the present day and a hundred years ago. He says—

> A hundred years ago agriculture was an art, having only few points of contact with natural science. At the present time both the materials and the operations of agriculture have been so far examined and elucidated by patient scientific investigations that we may now give the title of agricultural science to this edifice of true theory.

This is undeniably true, but agriculture will always remain an art if we consider that art deals with practical ways and means to accomplish certain things.

Science again gives us the explanation of these ways and means, so that really art and science have to work hand in hand to maintain agriculture in its present eminent position.

The science which helped agriculture more than any other is undoubtedly chemistry.

No other science, electricity perhaps excepted, has made such wonderful progress in the present century as chemistry; and there is hardly, in the present time, any occupation or industry in which chemistry does not play an important part.

Let us briefly consider what chemistry is. You all know that man, with all his science and wonderful appliances, has never and will never succeed in creating matter, any more than he can destroy existing matter.

All the bodies which surround us, the air we breathe, the food we consume, the clothes we wear, the earth on which we grow our crops, are all composed of a few distinct constituents, which at present cannot be further decomposed and which are called elements.

Only a few of these elements exist in nature in an uncombined state. The most of them are combined in such a wonderful manner that no one would suspect such combination, judging only by the ordinary senses. Who would, for instance, suppose that starch, cane-sugar, and cotton are simply composed of carbon and of water!

The science of chemistry has to come to our aid to tell us the nature of these combinations, and which elements take part in their formation.

Chemistry further tells us in which manner we can force the elements or combinations to unite and to form new bodies.

Chemistry also proves that all things are formed out of pre-existing matter. A plant which grows is not a creation but simply a transformation of other existing bodies. Again, when a plant decays in the ground, or when a tree stump is burned, the bodies which took part in their formation are not lost but simply transformed into other bodies which in their turn will again be assimilated by other growing plants.

Emerson, in one of his essays on farming, says—

Who are the farmer's servants? Not the Irish, nor the coolies, but geology and chemistry, the quarry of the air, the water of the brook, the lightning of the cloud, the castings of the worm, and the plough of the frost.

That chemistry is to be the servant of the farmer is now universally recognised, and consequently we find amongst the staff of Agricultural Departments a large number of chemists.

In the United States a very great number of agricultural experimental stations and agricultural colleges exist, and I may mention that, for instance, at the New York Agricultural Experimental Station out of a total number of 16 officers 7 are chemists; at the South Dakota Experimental Station and also at the Virginia Agricultural College out of 8 officers 3 are chemists; and at Alabama Agricultural Experimental Station, 4 out of 11. In the southern colonies, besides the agricultural colleges and experiment farms with their staff of experts, exist agricultural laboratories with chemists in charge and several assistants.

The work to be carried out at an agricultural laboratory is very large and of a varied nature, and consists chiefly in the following:—

Analyses of soils.
Analyses of waters, chiefly irrigation waters.
Analyses of manures.
Analyses of foods and feed-stuffs.
Analyses of dairy products.
Analyses of plants, fruits, and grains.

Experiments with wheats and testing them as to milling qualities, &c.
Practical experiments in the field.
Investigations about stock-poisoning.
Experiments and analyses of insecticides.
Preservation of meat and other products.
Experiments and investigations in agricultural industries, as sugar, wine, tanning, &c., &c.

The value of soil analyses to the farmers has been much discussed. Some authorities deny all value, and others again put too much faith in it. The truth must lie somewhere between these two extremes.

Chemical analysis alone is very often misleading, and I have analysed soils which according to the analysis should be first-class soils, but which as a matter of fact would not grow anything on account of their heavy clayey nature. This adverse property would, of course, have been found out by the mechanical analysis, which at the same time would point out that these soils could be improved by draining or green manuring.

Very often the analysis of a soil shows its deficiency in certain necessary constituents.

It is principally the want of nitrogen from which many of our soils in Queensland suffer, and this, perhaps, has to be attributed to adverse climatic conditions. The advantages of green manuring have been known for a very long time, but the scientific explanation of the fact that nitrogen is assimilated from our atmosphere by the help of the root-nodules of leguminous plants is only a recent discovery made by Professor Hellriegel. The active agents of this wonderful process are *Bacteria* found in these root-nodules.

Our farmers will find no cheaper or better way of supplying this want of nitrogen to their soils than by green manuring with leguminous crops; and the cow-pea (*Dolichos sinensis*), introduced from America by Professor Shelton, seems especially suited for this purpose, and yields excellent crops in different parts of this colony.

A crop of cow-pea grown in the Mackay district could be ploughed under after eight weeks' growth. This crop weighed 9·7 tons (vines and roots) per acre, and supplied to the soil per acre 2·87 tons organic matter, 150 lb. of nitrogen, 35 lb. of phosphoric acid, and 96 lb. of potash; these ingredients representing a manuring value of £5 per acre.

The analyses of waters, chiefly water used for irrigation purposes, is important, as very often the water during its passage through the earth may take up constituents which are detrimental to plant life.

The analyses of artificial manures is undoubtedly part of the most important work of the agricultural chemist.

It is of the greatest importance to the farmer to know if he really receives value for his money spent in manures, and it is a great pity that the Fertilisers Bill, regulating and controlling the sale of manures, was not passed by the last session of Parliament.

The farmer cannot afford to experiment with various manures, and in the choice of his manures he should be guided by the analyses and by practical results obtained at experiment stations.

Another important branch of the analytical work is the analysis of dairy products, foods for our own consumption, and feed-stuffs or fodder for our cattle.

Interesting experiments can be made with regard to the preservation of fodder in silos, which would show how far the nutritious value of the fodder is influenced by storage.

With regard to the testing of wheat, a large amount of work has been done in the New South Wales Agricultural Department by Dr. Cobb and Mr. Guthrie.

Of course it will be necessary to repeat these experiments with our own wheats. Over 300 varieties have been sown at the College farm. All of these will need testing, and this will involve a great deal of work during the coming year.

A great many interesting investigations can be carried out with regard to stock-poisoning, and to the yield of some of our native plants in volatile oils, valuable extracts, gums, resins, &c.

Very important also are experiments and investigations in our agricultural industries, in which chemistry plays an important part. Amongst the foremost of these stands our sugar industry.

The chemist is not only necessary for the cultivation of the cane crop by trying to improve its quality and quantity, and regulating and controlling the cutting of the cane, but he is also the principal man in the mill in order to control the losses and direct the process of manufacture. Other industries—as, for instance, preservation of meat, butter, and other products for export—will also come more or less under the control of the agricultural chemist.

But let us not forget that analysis alone cannot decide everything, and science alone is not sufficient for successful farming.

Experience and practice are absolutely necessary.

The chief aim of the Agricultural College about to be started is to teach our youths both the practice and science of agriculture, and thus to turn out useful, practical farmers, who can direct and investigate the why and wherefore of the necessary practical work by the elements of science.

Mr. WATT said there was a general impression among farmers that fertilisers put on land were apt to be largely carried away by draining. Nitrate of soda, for instance, was said to be easily carried away by drainage waters. He would be glad to hear Mr. Brünnich's opinion on this point.

In reply to this and other questions, Mr. BRÜNNICH said in using artificial manures in this colony there was always that danger. Tests had been made of the water coming from drains, and it had always been found they contained a large amount of fertilising materials, and for this reason he always advocated green manuring. For instance, a crop of cow peas represented a manurial value of £5 per acre. Although the cow pea, of course, took a large amount of nutriment from the soil, still most of its ingredients came from the air, and consequently the soil was bound to benefit appreciably by the addition of the cow-pea vines which had grown upon it. Even such materials as phosphoric acid, which the cow pea did obtain from the soil, were improved in manurial value by being assimilated by the cow pea, although in any event, in the case of phosphoric acid, soil has generally a superabundance of this substance. Cow peas also loosened the land mechanically, and were in most cases preferable to artificial manures. The cow pea could be applied to any crop, although his own experience had chiefly been with cane. There was no land so light that could not be benefited by it. He had made experiments with dozens of other plants for the purpose of obtaining similar results as those secured from the cow pea. Corn, sorghum, and several indigenous Fiji plants had been tried. Sunflower made an excellent green manure, as did also oats and rye. Leguminous plants, however, were far and away the best for this purpose. In the North the cow pea could be planted at almost any time, and about eight weeks elapsed from date of planting to the time when the crop was ready to be ploughed under. About 60 lb. of seed to the acre were required, and it was generally sown broadcast. In reply to a suggestion of Mr. Whiteley's, that the roots be left in the ground and the vines be fed to cattle, but whose manure should be returned to the soil, Mr. BRÜNNICH said such a plan would probably be equal in manurial value to ploughing the vines under direct, but it would most likely be more expensive.

Mr. ADAMS (Rockhampton) said he had been growing the cow pea for the last couple of years, and he had found it would not do in winter. It also seemed almost a sin to plough it under, it being such an excellent fodder. Even when he did utilise the vines for feed, he had always found the ground on which the peas had been grown greatly improved in quality.

Mr. THYNNE said a difficulty in cow peas was the mowing. If the vines were cut with a horse rake in the ordinary way they would get too much of the soil mixed with them, and they would not make as good fodder as they otherwise would. A new system, however, was to lift the cutter in a particular way and have a machine like a reaper and binder that would throw the vines on one side, so that the horses did not tramp on and spoil them. When these vines were ultimately prepared and stacked away they were excellent to mix with maize fodder.

Professor SHELTON said he had always taken the deepest interest in the cow pea. Mr. Brünnich's method of manuring was on the whole the cheapest and most satisfactory that could be employed. Barnyard manure was of course good, but the mere hauling of it, to say nothing of the cost of the manure itself, was a tremendous burden. Cow peas, on the other hand, required no special cultivation, and were easily ploughed under. As to time, do not plough under a great mass of green sour peas. Do not plough them under three or four months before you want to use the land. On the contrary, let the vines lie on the ground and rot there if needs be. Very little of their valuable ingredients would be lost, as the ground would absorb all the decomposing material and the rain would carry it down into the soil. Then when it was necessary to plough the land for the next crop, plough the decaying vines in. With regard to removing the vines for fodder, of course, if the manure was returned to the soil great benefit would accrue. Even supposing, however, the vines were made into hay and sold off the farm, the soil would still have benefited materially from the cow peas growing upon it. In the case of clover, this fact had been conclusively proved in England by Dr. Voelker. Mr. Brünnich had mentioned the mechanical effects of cow pea on the soil, and he would also like to mention the smothering effects. No weed could live where there was a crop of cow pea. Even nut-grass, he thought, might succumb to it. In fact Mr. Knox, of the Colonial Sugar Refining Company, had told him nut-grass could be completely smothered by cow peas. It was one of the most useful crops they could grow, whether for fodder or for green manuring.

Mr. WHITELEY asked if the cow pea could be used in an orchard.

Professor SHELTON said he would not advise planting cow peas or anything similar in an orchard, and Mr. MOULDAY agreed with him.

Mr. BENSON said they would be useful in an orchard as a mulch, but for nothing else.

Mr. CASWELL (Wallumbilla) also bore testimony to the value of the cow pea. He had been growing it four years, and had proved its value as a manure on land on which it had been ploughed under, on land on which it had been allowed to rot, and on land on which it had been grown, but from which the vines had been removed for fodder.

Mr. W. R. ROBINSON, of Toowoomba, then read the following essay on—

BACON PIGS AND HOW TO BREED THEM.

It is the duty of every farmer who keeps a pig to endeavour to produce a class of animal that he can obtain the highest price for. Buyers are always open to give a higher price for a good, shapely pig than a common ill-bred slab; moreover, the superior animal will give the breeder or fattener a quicker return than the inferior one. I am free to admit a wonderful improvement has taken place in our pigs during the past five years. The pig industry in Queensland promises to be a very large and profitable one. A few years ago, to see fifty or sixty pigs yarded at a sale was considered a big sale; in Toowoomba alone, we now put through as many as 450 on one sale. But there is still room for improvement in our bacon and pigs. The first point to be taken into consideration is the selection of the sire. The old idea of "half the breeding goes down the throat" is exploded. Take, for instance, the weedy-hammed pig that one often sees roaming about the up-country stations; all the feeding in the world will never make it a good, shapely bacon pig; you may put a certain amount of fat on it, and that's all. The Berkshire

is the recognised breed—in Queensland at any rate; his colour, activity, and general thrifty habits are more suitable to the climate than any other. White pigs are not thought very favourably of, owing to the sun causing their skin to crack and become scurfy. Therefore, secure a pure Berkshire boar to start with, and in doing so select a boar from a pure herd, whose breeding is not doubtful; go and see his sire and dam if possible, and satisfy yourself that they possess all the good qualities of what good bacon pigs should be—namely, quiet disposition, plenty of length, short face, wide between the eyes, face well dished, level underline, good back slightly arched, ribs well sprung, hams deep, round, and full; good silky coat of fine hair, and plenty of it; well-set legs, erect ears—nice and fine. Always avoid a coarse, heavy-boned, rough-looking boar, and remember that like begets like. The sow should be rather opposite to the boar. What a farmer wants is a good, long, roomy sow, rather coarser than the boar. There is no need for her to be pure-bred; better not, as pure sows are not prolific enough for ordinary purposes. The half or three-quarter bred sow that will give her owner ten to thirteen pigs at a litter, and rear them well, is the class of sow to mate with the pure sire. Always avoid short, nuggety sows for breeding purposes; they, as a rule, give poor litters, are bad mothers, are apt to lay on fat in place of yielding a large supply of milk for their young, whereas the long, roomy sow will, if anything, lose condition while rearing her litter, because she is the better milker of the two. The brood sow should have plenty of exercise while in young; she should be active, thrifty, and not of a delicate constitution; a good feeder, with great digestive powers. The next point—and a very important one—after you have got your litter of young pigs, is to keep them growing, and this is where so many farmers fail. The most serious complaint with many litters is scours. This is generally caused by a sudden change of food not suitable to the sow; the best remedy I have found is to give the sow a few feeds of pollard mixed rather dry, with a little chalk; or if the young pigs have got to that age that they will drink out of the trough, mix a little soot with their food. Either of these simple remedies will check the complaint. Young pigs should not be allowed to go back for a day; they must be kept growing as rapidly as possible if you want to get them off your hands. Remember after three weeks the sow is gradually becoming unable to supply their wants. Your duty then is to provide for them. The best plan is to let the sow out for an hour or two during the warmer part of the day, and give the youngsters a little sweet milk in a small shallow trough; they will very soon come up and learn to drink; and you then can gradually leave the sow out a little longer every day, and increase their food, adding pollard, bran, boiled crushed maize, barley meal, or potatoes. In this way they come on very quickly, and never really require any weaning, although it is often advisable to remove them to another pen. Give them plenty of good warm bedding to nestle in; cold, damp, draughty pens are always to be avoided; warmth is a great thing to help pigs on; they cannot stand cold or draughts. I am sorry to say too little attention is paid to piggeries. Small lucerne paddocks make the best run for growing pigs. Three and four months' old pigs fed in their pens of a morning and allowed the run of a lucerne patch all day and put into their pens and fed at night, come on very quickly; they make better growth than pigs constantly penned up; five to six months' old pigs treated in this way should fatten readily. When fattening or topping off, an acre or two of peas is about as fine a feed as you can turn them on to, but few, if any, farmers seem to try it; they prefer to stick to the old plan of throwing them in a number of cobs of corn for the pigs to worry at, and in dirty pens they waste as much as they eat. Maize is a fattening food, and amongst the best, but it is very heating, and pigs become tired of it; they want green food with it, also coal or charcoal, a little salt and sulphur now and then. Corn and cob meal is a splendid food, and, I think, better than whole corn. Pea-fed pork is worth more than any other, and I think it is a crop well worth our farmers trying. After your pigs are fattened up to 140 lb. to 150 lb. weight, every day you keep them they are eating their heads off; so

you must make it your business to clear them, and have stores ready to take their place. There is one little item I find I have overlooked, and that is: To see your pigs have plenty of clean water every day; there is nothing they like better, and although you may think you have fed your pigs well they may be languishing for a drink.

In reply to a question of Mr. H. M. Stephens,

Mr. Robinson said he believed in boiling or soaking corn cobs or meal for young pigs.

Mr. Armstrong coincided with the statement as to the value of pure-bred sires. Like Mr. Robinson, however, he also preferred half-bred sows. Till they were five months old he allowed his young pigs the run of a 20-acre paddock. With regard to colour, too, he had always found black far superior to white.

In reply to Mr. Whiteley, Mr. Robinson said he did not know of any Essex pigs in Queensland. The improved Berkshire was ready for market when about five or six months old.

In reply to another question, the reader of the paper said lumpy jaw in pigs was a disease that only seemed to occur in offal and slaughter-house fed pigs. Pigs with such a disease, he added, should be immediately destroyed.

Mr. McConnell (Cressbrook) mentioned the case of pigs losing their strength in the loins when they were about three or four months old.

Mr. Robinson said this was caused by a small worm in the kidney or kidney fat. A little dose of turpentine given in the pig's food was a good remedy, as was also rubbing turpentine externally across the loins. It was rather difficult to administer medicine internally to pigs, but one way was to give the pig the toe of an old boot to chew. While the pig was doing this the medicine could be poured down the upper of the boot, and a hole having been previously made in the toe, the liquid would run through it down the pig's throat.

A gentleman present mentioned Red Tamworths, and stated that although they made excellent bacon, they took too long to come on to be good commercial pigs.

Mr. Robinson said he had had no personal experience with the Red Tamworth, but he believed the Messrs. Chirnside, of Melbourne, had some very good specimens of the breed. He further added, in regard to sires, that a bad practice of some farmers was to get a pure-bred boar, but when he was dead get one of his progeny from some half-bred or mongrel sow and put him in the place of the late sire. When a new sire was wanted they should always get a pure-bred one from a well-known herd. Another thing he would impress upon them was the importance of hair in the selection of swine. Always get a pig well covered with good hair. It was an excellent sign to go upon.

In reply to Mr. Caswell, Mr. Robinson said pouring hot lard into their ears was a good remedy for pigs suffering from staggers. Another good way was to hit them a sharp blow between the ears or on the nose; in the latter case hard enough to make the nose bleed; or they could be bled behind the ears; bleeding would nearly always effect a cure. Other remedies for the same disease were a little bran mash with some Epsom salts; or else use an enema, injecting soap-suds and castor oil.

Professor Shelton congratulated Mr. Robinson on his paper. Black was the right colour for pigs. In America, for every one white pig seen there are 100 black ones. The Poland China was an excellent pig; but it was hardly worth while introducing him here. He reaches an immense size; but in Queensland a 250-lb. pig is unsaleable. The Berkshire met their requirements much better. The Essex was only a little ball of fat. His flesh lacked the layers of lean and fat which makes good bacon. Lucerne paddocks were excellent for the pigs, but not good for the paddocks. The pigs' sharp feet would soon cut the plants, and the lucerne would have to go. This, of course, was the only objection to the use of lucerne in the way advocated. With

regard to grinding the whole corn cob, it was necessary that it should be ground to the condition of powder, otherwise it was not worth while feeding it. In grinding whole cobs it took 33 per cent. more labour and energy to do it than it did to grind a similar weight of shelled corn only. The core made up 18 per cent. of the whole cob. He thought it was a mistake to boil corn for pigs. Some years ago several of the American experiment stations, his own among the number, carried on a series of elaborate experiments on this point. At these, given numbers of pigs were fed on different rations, and the results of the experiments unanimously showed that a pound of raw meal gave something like 10 per cent. more pork than a pound of boiled meal. This experiment referred solely to corn meal. Many other foods, however, might be improved by boiling.

Mr. ROBINSON said he had not meant to convey the impression that farmers should boil all the corn or cornmeal they intended for their pigs. He had referred to young pigs, particularly those at the weaning stage. Boiled meal seemed to better suit the digestive organs of the young animals. In winter especially they seemed to prefer warm feed at night.

Mr. STUCKEY said he had had some experience in pigs, and could thoroughly endorse Mr. Robinson's remarks. He had found the Berkshire the best kind both for rearing and curing. It matured early. The white kinds also came to maturity early, but they were all fat, and consequently unsaleable. With regard to the disease that might be called the staggers, and which caused the pig to keep turning round, endeavour to climb posts, and otherwise seem to lose its head, he might say that if one killed and examined such a pig it would be found that one of its kidneys would be completely gone, and nothing but a bladder of water left. Pigs, however, often seemed to recover from this disease. He agreed with Mr. Robinson in attributing the weakness in the loins to a worm in the kidney. He had seen this worm, and had found it also in the spine. He had seen pigs with well-developed and healthy forequarters, but the hind parts completely gone owing to the action of this worm. In conclusion, he advised those present, who were interested in swine, to avail themselves of the first opportunity to inspect the Zillmere Bacon Factory.

Mr. COULSON mentioned spaying as an operation that was largely carried on in some of the pig-raising districts of England. In reply, Mr. ROBINSON said that he had never practised this operation, and personally did not think it worth while in Queensland. In America and England large pigs were the rule, but here the markets demanded a lighter animal, and consequently the operation would be of little practical use. He found sows throve better if left alone. In further reference to staggers, pumpkin seeds should be avoided in feeding pigs. Such seeds might cause strangulation of the bowels.

Mr. T. WHITELEY mentioned that a lot of his pigs had been killed by scrub ticks.

Mr. ROBINSON said personally he had never known pigs to be killed by scrub ticks. Lice were troublesome sometimes, but the best thing for them was a little kerosene.

Mr. COULSON said he had known scrub ticks to be destructive to pigs. Kerosene applied externally and internally was a good remedy.

Mr. J. LELY also contributed to the discussion. Large numbers of pigs were raised in North Queensland, and an additional adjunct to its diet there is molasses. Curing bacon was of course difficult there, and the pig was chiefly raised for pork, although, doubtless, excellent bacon could be made in several parts of the North. He knew something of the "staggers," and had seen whole litters of pigs go off in twenty-four hours after developing its symptoms. It was evidently a form of congestion of the brain, and such a congestion could arise from an action of the kidney. The feeding of the animal on hot foods, when not accompanied by a warm sty, might also produce this congestion. There might of course be many causes for this malady, and in fact it might be the result of several different diseases.

Mr. R. HOGGAN then gave notice of proposed resolutions of the Recommendations Committee—

"1. That this Conference supports the recommendations recently made in England to the Imperial authorities by Mr. Jager and others in reference to the advisability of admitting tea, coffee, and cocoa into Great Britain free, and the imposition on foreign beet sugar of a duty equivalent to the amount of revenue now obtained from the tax on tea, coffee, and cocoa.

"2. That this Conference is of opinion that such a course of action on the part of the Home Government would be a distinct gain to Queensland and the other tropical and sub-tropical British colonies, and a step towards Imperial federation; and it would therefore recommend that this motion be cabled by our Government to Sir Hugh Nelson, to be placed before Mr. Chamberlain.

"3. That this Conference recommends the passing of a Drainage Act for allowing reasonable rights to owners and occupiers of land for taking their surplus water through adjoining properties; and also recommends to the various associations here represented the consideration of the question of extensive co-operative drainage with a view of approaching the Agricultural Department for the purpose of obtaining State assistance for the execution of such work."

On the motion of Mr. NOAKES, the committee were also requested to bring up a resolution with regard to the inspection of pigs for human consumption.

Mr. T. WHITELEY asked the Chairman if it was intended to distribute any of the Department's Ayrshire bulls in the Central district?

In reply, Mr. THYNNE said that at present it was not thought advisable to send any of the animals in question to districts where they were liable to be attacked by ticks, until such time as bulls could be sent that were immune against the disease. As soon as this could be done the matter would be attended to.

The Conference then adjourned to the agricultural implement shed, where Professor Shelton delivered an informal lecture on

FARM IMPLEMENTS.

Professor SHELTON explained the various implements in the shed. Among these was a subsoil plough which could be purchased for about £4. It was, however, one that any blacksmith could make. It only required two horses. The next was a Yankee stirring plough. This was an excellent soil pulveriser, and was one that would probably be good for turning in green manure. It was chiefly useful for land with a heavy subsoil. He would not specially recommend it for red soil, as that land is generally sufficiently friable. A machine for cultivating corn was explained. In certain States of America maize was the great crop, and one could ride for hundreds of miles and see on either side of him, as far as the eye could reach, nothing but fields of this cereal. The key to corn-growing in that country was the "corn marker." By its use they marked 11 acres a day, got ahead of weeds, and got straight lines. It was no use trying to raise corn cheaply unless they had straight lines. The seed could either be planted in drills or by the "check row" system. In the drills the larger yield was obtained, but under the check row the land could be cultivated more cheaply. The extra yield in favour of the drill system was averaged at about 8 bushels per acre. The lister was simply a double mould-board plough, which threw the earth left and right. About 6 acres a day could be managed with this implement, the ploughing, planting, and covering all being done in one operation. This plough was also provided with a subsoiler. Sulky listers could be obtained which did the same work, with the man driving. The lister in the States costs about £6. Farmers getting their tools direct from America should get them from New York, and have them sent out by sailing vessel. This took longer than when they were sent out by steamer from San Francisco, but it was far cheaper. Maize planted by the lister would stand drought better than when planted any

other way. The lister was best suited for flat land, and should not be used for ploughing hill-sides, because rain would wash out the furrows. It was very useful in the destruction of weeds. A practical demonstration was given of the use of a check row planter, the object of which was to save marking. He had purchased this machine for £10, although its price in the States used to be about £15. Mr. Chamberlain, of Gowrie, was using a similar implement at the present time.

The corn harvester was a tool that a blacksmith could make for about £3. Mr. Marriage, of Yangan, had one in use at Killarney.

A side-hill plough, which cost about £3 5s. 6d. in Sydney, was very useful for ploughing down the side of a hill, and also for gardening.

A roller, a rake, an Acme harrow, and a walking cultivator were also explained. A walking cultivator was to be preferred to a riding one.

This concluded the session.

(*To be continued.*)

Probable Meat Trade with Egypt.

In his report to the Home Secretary on the possibilities attending the opening up of a fresh market for tinned meats and for the disposal of live cattle, dated 6th April, 1897, Mr. Finucane, Queensland Commercial Agent in Southern Europe, states his impression that a live cattle trade might be initiated in Egypt with a fair prospect of success. During interviews held with officers who had experience with Australian meat in Malta and in England, he found that in every case the meat was reported on favourably. The principal obstacle to a paying trade in Egypt is the price. The authorities provision the garrison at Cairo at 3½d. per lb. all round for beef and mutton, and General Knowles, commanding the army of occupation, had recently (6th April, 1897) signed a contract at that price for the ensuing twelve months. The Egyptian meat supplies are drawn from the following countries:—

Mesopotamia and Odessa	Cattle.
Syria	Sheep.
Greece	Pigs.

Owing to the prevalence of disease amongst these animals, the Chief Veterinary Inspector of the Government of Egypt and others are anxious to put a stop to the importation of cattle from these countries.

Acting on the advice of the former gentleman, Mr. Finucane waited on Lord Cromer, and asked if His Lordship would submit the question of facilitating the introduction of Queensland cattle into Egypt.

This the latter at once consented to do, and pending a reply it would be well for the Pastoralists' Association and others interested in the meat export trade to consider the question of sending cattle to Egypt, and then to strengthen Mr. Finucane's position by supplying him with full information as to freights, the supply that can be relied on, weight of beasts, prices that will pay, and especially as to Government guarantee that cattle shipped are free from disease.

The latter item is of paramount importance, as since writing his report our agent has seen all the officials concerned, and they are quite willing to facilitate the introduction of live cattle if guaranteed sound by the Government.

TINNED MEATS.

It would appear from the report under consideration that eventually a good market may be found in Egypt for Australian tinned meats, which are absolutely unknown there, American goods being in general use.

Mr. Finucane makes several suggestions as to advertising their meats in the country, which will no doubt commend themselves to Queensland export of tinned meats companies.

Meanwhile the attention of the companies interested has been directed to Mr. Finucane's report, and they will thus be in a position to take whatever action they may think best to open up what may prove a very lucrative trade.

A list is appended to the report showing the number and kinds of animals slaughtered at various centres in Egypt for food during the month of January, 1897:—

Bullocks and bulls	1,967
Cows	1,138
Buffaloes	1,357
Calves	6,688
Sheep	26,073
Goats	613
Pigs	639
Camels	79
Total	38,554

Besides which number 1,824 were destroyed as being unfit for food.

Botany: Contributions to the Flora of Queensland.

By F. MANSON BAILEY, F.L.S.

Colonial Botanist.

Order MALVACEÆ.

SIDA, Linn.

S. argentea, *Bail.* (n. sp.) The stems, petioles, as well as most other parts of the plant closely clothed with silvery peltate, ciliate scales. Stems or the lower branches from a procumbent stem erect, slender, about 12 in. high. Leaves rather distant, erecto-patent, narrow-linear, 1 to 2½ in. long, 1 to 2 lines broad, slightly tapering towards the point, rounded at the base to a petiole of a few lines. Stipules subulate, nearly as long as the petioles. Peduncle axillary, solitary, filiform, about 8 or 9 lines, articulate above the middle. Calyx under 4 lines diameter, lobes deltoid, silky-hairy on the inside. Petals twice as long as the calyx, broadly-cuneate, almost roundly-lobed at the end, veined. Stamens under 10. Style-branches recurved. Carpels hairy, probably few, but only imperfect specimens to hand.

Hab.: Eulo, Paroo River, *J. F. Bailey*, Dec. 1896. The thick coating of the silvery scales gives to the thin stems the appearance of silver rods.

Order STERCULIACEÆ.

RULINGIA, R. Br.

R. rugosa, *Steetz*, Flora Austr. i. 238. A shrub so closely resembling *R. pannosa* in indumentum and foliage that it is difficult to distinguish it without the fruit. Leaves usually narrower, more rugose, and almost bullate. Flowers in cymes, scarcely exceeding 2 lines in diameter when expanded. Ligula of the petals marked with 3 dark lines. Ovary tomentose. Capsule about 4 lines diameter without the setæ, not so hard as in *R. pannosa*, and readily dehiscent, beset with soft pubescent setæ, which is long in some specimens, short in others.

Hab.: Capalaba, *J. Shirley*.

Order AMPELIDEÆ.

VITIS, Linn.

V. adnata, *Wall.*, Flora Austr. i. 448. The young shoots and under side of the leaves more or less covered with a short tomentum, which sometimes disappears with age. Leaves petiolate, broadly cordate, almost orbicular, acuminate, 3 to 6 in. diameter, bordered with small bristle-like teeth, 5-nerved, and pennniveined, the primary veins connected by transverse veinlets. Flowers scarcely ½-line diameter, numerous in corymbose cymes. Petals 4, cohering by the tips and falling off together. Style shortly subulate, at least in the fertile flower. Fruit small, globular. *Cissus adnata*, Roxb.; Wight, Ic. t. 144.

Hab.: Ranges about Cairns, *L. J. Nugent*.

Order LEGUMINOSÆ.

KENNEDYA, Vent.

K. exaltata, *Bail.* (n. sp.) A robust pubescent climber, according to Mr. E. Cowley, attaining to the tops of tall trees. Stems hairy. Stipules oblong-lanceolate, 7 or 8 lines long including the portion (about 3 lines) produced below the insertion, clothed with appressed hairs; stipellæ very narrow and the lower ones rather long. Petioles about 4 or 5 in., petiolules from 1 to 1½ in. long. Leaflets 3, somewhat orbicular in outline, 2 to 5 in. diameter, the lateral ones 2, the terminal usually broadly 3-lobed, the midrib of each lobe ending in a bristle-like point, pale on the under surface. Racemes axillary; peduncle somewhat flattened, about 3 in. long, bearing about the centre a hairy lanceolate bract; raceme or portion bearing the flowers about as long as the peduncle. Flowers solitary or in pairs (violet-coloured and very attractive, *E. Cowley*). Pedicels about 2½ lines long, curved, hairy. Calyx-tube gibbous, very hairy outside and slightly so inside, long as the pedicel; the two upper lobes united to the end, 3½ lines long; lateral ones about the same length, but more acute; the lower or keel lobe about 6 lines long, somewhat acute. Standard obovate, about ¾-in. long, with 2 auricles at the base of the lamina, claw short, the wing and keel petals about as long as the standard, all obtuse. The free stamen sometimes, if not always, connate for some distance up with the others. Ovary stipitate, hairy; upper portion of the style glabrous. Stigma terminal. Pod not seen.

Hab.: Scrubs of the Barron River, *E. Cowley*. The flowers upon the specimens received being all more or less injured by insects, the absence of pods, as well as the peculiarity noticed in the stipules and stamens, may, when better known, cause this plant to be removed out of the genus in which I now place it; but with the material to hand I can do nothing better with it.

CASSIA, Linn.

C. Brewsteri, var. Marksiana, *Bail.* (n. var.) An erect tree of 50 or 60 ft., trunk 12 or more inches in diameter; wood pinkish, close in grain, and tough; branchlets dark-coloured, fluted. Leaves 8 or 9 in. long, bearing about 7 or 8 pairs of leaflets, glabrous except for a slight tomentum upon the rhachis; leaflets from nearly lanceolate to oblong-ovate, 1 to 3½ in. long, shortly petiolulate; the leaves nearest to the flower racemes often of only three leaflets. Racemes terminal on the branchlets, about 3 in. long. Flowers crowded, on slender pedicels; bracts minute. Sepals oblong, 3 lines long, pubescent on the back. Petals yellow, 5 or 6 lines long, obtuse, tapering to the base, marked by a dark central and distant lateral veins. Stamens of the normal form. Pod about 1 ft. long, 5 lines broad, nearly terete, dark glossy-brown, and marked with transverse ribs between the seeds.

Hab.: Upper Nerang Creek. Foliage and wood, *F. M. B.* 1886. Flowers, pod, and leaf, *Hon. C. F. Marks, M.D.*, Dec. 1896.

I saw trees of this form growing at the above locality when collecting timbers for the Colonial and Indian Exhibition in 1886, but could not then obtain flowers or pods, and, thinking that the distinction in foliage might be due to situation, had a log worked up, and gave it in the catalogue as var. *tomentella*, an error which must be corrected in the next edition of the Queensland Woods.

Order MYRTACEÆ.

MELALEUCA, Linn.

M. thyoides, *Turcz.*, Flora Austr. iii. 162. A tall shrub with numerous small slender branchlets, usually whitish, but glabrous or nearly so. Leaves spirally arranged, scale-like, closely appressed and imbricate, thick, peltate and concave, very obtuse and scarcely ½-line long on the smaller branchlets; more distant, acuminate, and nearly 1 line long on the longer branches. Flowers

whitish, in ovoid globular or oblong heads, terminal or the axis very soon growing out into a leafy shoot. Calyx-tube ovoid-campanulate, about ¾-line long or shorter and broader in the males, with very short and broad lobes. Petals ½ to ¾ lines diameter. Staminal bundles 2 to nearly 3 lines long, the claws exceeding the petals, each with 5 to 9 filaments at the end. Stigma dilated. Fruiting calyxes truncate, in some specimens about 1½ lines diameter, in not very compact globular heads; in others 2 lines diameter, in very dense oblong spikes; in others again still larger and only 2 or 3 together. Cotyledons very broad and folded. *M. cupressina*, F. v. M., Fragm., iii. 114.

Hab.: Lake Dunn Station, *Miss C. E. Crossman.* Only a few small specimens received, which seemed intermediate between *M. thyoides* and *M. tamariscina*, Hook.

Order SAPOTACEÆ.

SIDEROXYLON, Linn.

S. Dugulla, *Bail.* (n. sp.) (The aboriginal name at Barron River, *E. Cowley.*) Tree of about 70 ft., trunk diameter 2 ft., bark grey with numerous shallow longitudinal cracks. The young slightly hairy, leaves oblong-lanceolate, 3 to 5 in. long, and seldom exceeding 1 in. wide at the broadest part, tapering from above the middle to a petiole-like base; the apex usually very blunt, glabrous on both faces, the upper glossy, texture thin. Flowers not seen. Fruit nearly sessile and almost globular, green, 1 in. or more in diameter, containing 5 seeds, embedded in a soft pulp. Seeds brown, glossy, ½-in. long.

Hab.: Barron River, *E. Cowley.* Fruit eaten by natives.

Order VERBENACEÆ.

CLERODENDRON, Linn.

C. lanceolatum, *F. v. M.*, Fragm. III. 145, Flor. Austr. v. 63. A tall shrub or small tree, the foliage and inflorescence softly velvety, pubescent or glabrous. Leaves on rather long petioles, lanceolate or ovate-lanceolate, acute or rather obtuse, 2 to 3 in. long. Cymes in the upper axils several-flowered, shorter than the leaves, on short peduncles. Bracts narrow, acute, or the outer ones more leafy. Calyx broadly campanulate, about 2½ lines long when in flower, divided to near the middle into obtuse lobes. Corolla usually pubescent outside, the tube about ¾ in. long, or rather more, the lobes scarcely 3 lines. Stamens rather long. Fruiting calyx enlarged, of a deep purple colour, very open, 4 to 5 lines diameter, the lobes recurved. Drupe oblong, about 4 or 5 lines long, near or quite black when ripe.

Hab.: Torrens, near White Mountains, *R. C. Burton.* Coomooboolaroo, *Mrs. G. Barnard.*

Order LAURINEÆ.

ENDIANDRA, R.Br.

E. insignis, *Bail.* (*Cryptocarya insignis*, Bail. Bot. Bull. II. 15.) Flowers minute in slender trichotomus panicles under 2 in. long, pedicels slender longer than the flowers. Flowers nearly globular in the bud, usually about a line long; outer segments nearly rotund, inner ones somewhat apiculate, hairy on both sides. Stamens (in the flowers examined), the 3 inner ones alone fertile. Ovary and style more or less hairy.

Hab.: Ranges about Cairns, *L. J. Nugent.* Flower specimens. In Bot. Bull. II. this tree was placed in Cryptocarya, but no flowers had then been seen.

Order ORCHIDEÆ.

BULBOPHYLLUM, Thon.

B. radicans, *Bail.* (n. sp.). Stems elongated, sometimes to the length of several inches, clothed with scarious, striate, torn sheathing scales, and long wiry roots. Pseudobulbs narrow-cuneate, mostly hidden by the stem-scales. Leaves linear 1½ to 2½ in. long, 2 to 2½ lines broad, tapering at the base, the apex with a minute recurved point, texture thin, veins obscure. Peduncles 3 or 4 lines long, filiform, bearing 2 or more loose, scarious, somewhat obtuse sheathing bracts. Flowers yellow, calyx-tube slender, 1¼ lines long. Sepals broad-lanceolate, the points acute, 1¼ lines long, longitudinal veins 3 to 5. Petals narrow-lanceolate with only a central vein, hyaline and scarcely half as long as the sepals. Labellum thick, nearly as long as the sepals, expanding into side-lobes in the lower half, attached by a short claw to the basal projection of the column, disk-plates 2. Column-wings ending in rather long incurved threads. Pollen-masses oval, golden-yellow. This species is nearly allied to *B. nematopodum*, F. v. M., and it is probable that the specimens mentioned in my report of the Bellenden-Ker Expedition in 1889 as *B. nematopodum*, which were not bearing flowers at the time, belonged to this new species.

Hab.: Range near Cairns, *L. J. Nugent.*

Order FUNGI.

COPRINUS, Fries.

C. micaceus, *Fries.* Cooke Handb. Austr. Fungi, 69. Cke. Ill. t. 673. Pileus submembranaceous, oval, then campanulate (2-4 cm. broad), subrepand striate, discoid, sprinkled with fugacious, micaceous granules, at length naked, rimoso-sulcate; stem hollow, silky, even, whitish (8-10 cm. long 5 mm. thick), gills adnexed, lanceolate, whitish, brown to the middle, then turning black. Spores 8 x 6 μ.

Hab.: At the base of a decomposing mulberry stump in a Brisbane Garden.

XEROTUS, Fries.

X. Drummondi, *Berk.* Cke. Handb. Austr. Fungi, 100. Gregarious; pileus reniform, lobed, or crispate, ferruginous, tough, smooth (1 cm. broad), attenuated behind into a short obconic stem; gills distant, adnate, rather broad, becoming blackish.

Hab.: Eumundi.

HYDNUM, Linn.

H. delicatulum, *Klotsch.* Cke. Handb. Austr. Fungi, 172. Pileus effused, reflexed, coriaceous, thin, margin reflexed, narrow, yellowish, hymenium becoming whitish; spines very thin, regular, distant, setaceous, punctate with brown.

Hab.: On Eucalypt bark, Jimbour, *C. J. Gwyther.*

DICTYOPHORA, Desv.

D. phalloidea, *Desv.* Cke. Handb. Austr. Fungi, 211. Pileus thickened at the apex, at its union with the stem; stem white lacunose, with 2 or 3 strata of cavities; indusium net-like conic, or campanulate, white, arising from lower margin of the pileus, and depending almost to the volva, with the lower margin entire; pileus campanulate or conical, white, externally reticulate.

Hab.: On the soil, Oxley Creek, *D. O'Connor.*

DIACHÆA, Fries.

Sporangium stipitate; stem prolonged within the sporangium as a columella, and, together with it, filled with small granules of lime; capillitium of threads extending from the rigid columella to the wall of the sporangium, becoming thinner and thinner, combined into a thick net. *Cooke Handb. Austr. Fungi.*

D. leucopoda, Bull. Cke. Handk. Austr. Fung. 403, Cke. Myx. 44, fig. 178. Sporangium cylindrical, obtuse, stipitate; stem short, thickened at the base snow-white, prolonged within the sporangium into a cylindrical, obtuse, white columella, not reaching to the apex; threads of the capillitium whitish, thin; spores translucent, violet, beautifutly iridescent 7-9 μ diam.

Hab.: On a living plant of Ophiopogon growing in a bush house at Indooroopilly.

USTILAGO, Pers.

U. australis, Cooke's Handbook of Aust. Fung. 324. Produced within the ovaries; spores black, subglobose or angular and deformed, smooth, 8 μ diameter, or 8 x 6 μ.

Hab.: On infloresence of an Eriachne, Muckadilla, *Mrs. Trenouth.*

VERMICULARIA, Fries.

Perithecia erumpent or subsuperficial, thin-carbonaceous, black, globose conical, at length concave, the summit perforated or mouthless, clothed with rigid somewhat long sooty septate bristles, sporules cylindric-fusoid, often unequal-sided, continuous, hyaline, on various basidia.

V. herbarum, *West.* Sacc. Syll. Fung. III., 226. Perithecia somewhat loose, gregarious, erumpent-superficial, globose, depressed ½ mm. diameter, black, covered with crowded rigid, unequal, dark bristles. Sporules cylindrical, nearly straight, obtusely rounded at the ends, 20-22 x 3-4 μ, granulose, hyaline.

Hab.: Destructive to Carnation plants in a Brisbane garden. This fungus is known to infest plants of Dianthus, Solanum, Sedum, Yucca, &c., in Europe and South Africa.

General Notes.

RUBBER IN UPPER BURMA.

The *Imperial Institute Journal* for April, 1897, has the following on the Rubber Industry:—"From a recent report on the forests of Upper Burma, it appears that the difficulties of transport from the Hukong Valley are increasing as the more accessible of the rubber trees are being worked out. The forests at the head of the Namkong are rich in rubber, and the tree attains a height of 200 feet, with an enormous girth. The Kachins go far and near to collect the rubber in the dry season, and the chiefs levy toll on the produce as it passes down the rivers. The Chinese control the trade, selling provisions and cloth to the Kachins, who pay in rubber. The produce of the forests within the drainage area of the Tarou River goes to Assam, across the passes of the Patkoi Mountains. Rubber in this district is said to be growing scarcer, and it often takes a man forty days to collect a coolie-load, although the Singpho villages levy a tax on each collector. When first collected the rubber is very pure, but the Nagas have acquired the trick of adulterating it with earth and stones, so that Assam rubber is not regarded with favour in the Calcutta market. The rubber that goes to Rangoon is also adulterated, the Chinese being adepts in the art. The report states that it is useless to apply legislative protection and regulation to these rubber forests, unless the districts are taken over and administered directly, for the Singphos are extremely independent and own no masters, while some of the chiefs affirm that they could not enforce rules or interfere with the collectors. But the protection of the trees growing within our own administrative sphere would be possible, though Kachin opposition would have to be dealt with."

THE BUTTER INDUSTRY OF CANADA.

From the same journal we quote some remarks on the Butter Industry of Canada which are of interest to Queenslanders at the present juncture:—"Much careful thought has lately been given to the butter industry by the Government of Canada, where, owing to the vast and magnificent pasturage, it is capable of almost illimitable expansion. A glance at the Board of Trade returns shows that there is ample scope for the export of this product to the mother country. During last year the United Kingdom imported £15,344,083 worth of butter, of which Denmark alone sent £6,288,407 and France £2,537,690. Although during recent years Canada's contribution has increased, yet the necessity for greater efforts is demonstrated by the fact that in 1896 the value of the Canadian article imported only amounted to £339,744. The action of the Government in arranging for the requisite cold storage, both on land and sea, will be of incalculable benefit to Dominion farmers, and give additional impetus to the export trade. During the present year the Department of Agriculture has arranged to open in Manitoba and the North-west territories seventeen creameries, to be worked on the co-operative plan, under Government supervision. The charge to be paid by farmers to the milk department for manufacturing will be 4 cents per lb., with a further 1 cent per lb. to defray the Government loan, and it is expected that the monthly output of produce for export to Great Britain will reach a value of some 30,000 dollars."

THE BRITISH IMPORT TRADE IN EGGS.

The British Import Trade in Eggs has since the year 1850 exhibited a most remarkable growth, and there seems no reason why Australia should not have a large share in that trade.

The *Board of Agriculture Journal* says that fifty years ago the importation of eggs into the United Kingdom amounted to 3 eggs per head of the population of Great Britain and Ireland, but so great has been the subsequent growth of the trade that in 1896 the supply from abroad reached a total of 40 eggs per head. Last year the importation amounted to 1,589,387,000, of the value of £4,185,000. Until 1870, 90 per cent. of the imports into the United Kingdom was received from French ports; and though France still contributes a large proportion, her consignments to this country have decreased consistently during the last twenty years. Neither Belgium nor Germany produce sufficient eggs to meet the demands of their own population; and though it appears from the statistical tables that large quantities are received from these countries, it must be pointed out that the bulk of the receipts from Belgian ports consists of Italian and Austrian eggs, while those arriving from German ports are for the most part the produce of Russia and Austria-Hungary. From the declared value of the imports, we learn that the average value of the eggs imported for the last twenty-five years ranged from 7½d. to 10¼d. per dozen. The supplies from France fetch the highest price, and Italian and Danish produce come next.

The highest figure given in the average price here does not seem excessive, but when the raising of poultry for export is carried on, as it will be on a large scale, doubtless efforts will be made to also compete with European countries in the egg market, as Queensland has already successfully done in the butter and fruit market.

PRICKLY PEARS FOR STOCK.

It is perhaps not generally known that in Mexico the prickly pear is not regarded as an evil, but as the very reverse.

The Rev. Herbert Heath, who lately left Queensland, stated that he had resided for many years in Mexico, and had had many opportunities of observing the uses to which the prickly pear was put by the rancheros. In dry seasons, and even during good seasons, the vaqueros and peons go out on to the runs and cut down quantities of mesquite bushes, and make piles of them at intervals over a large extent of country. Labour being plentiful and very cheap, the work is performed in quicker time than might be supposed.

Quantities of prickly pear are now cut and thrown on to the heaps, which are then fired. The heat and evolved steam disarm the leaves and fruit of their thorns and prickly hairs, and the cattle assemble and eat the juicy leaves and succulent fruit with greater zest than they ate the grass.

In reply to a question we asked about the possibility of destroying and exterminating the plant in Queensland, Mr. Heath said: "You don't know the valuable fodder plant you have here. I can tell you this: Take away the prickly pear from Mexico, and rancher, rancheros, vaqueros, and all who have to deal with cattle may leave the country, for there will be no further employment for them. Cattle will be a thing of the past." We shall be glad to know if the prickly pear has been systematically tried as fodder in Queensland.

FARMING BY THE WEALTHY CLASSES.

In the course of an address to the Dominion Shorthorn Breeders' Association at Toronto (says the *Live Stock Journal* of 30th April), the President (Mr. A. Johnston, of Greenwood, Ontario) said: "If I were asked my opinion as to the greatest want in shorthorn matters in this country and in the United States, I would unhesitatingly answer—that of moneyed men who take an active and participating interest in this and in all other matters pertaining to agriculture. In the old lands it is vastly different. There, from Royalty down

to the tenant-farmer, all take a patriotic pride in being connected with the soil on which they live, other than mere ownership and revenue derived therefrom. I think the subject is worthy of the consideraton of our men of wealth. It is not to be hoped that the wealthy can make money in any line of farming, but the country can never prosper while only the very poor farmer tills the soil; and if men of wealth and social standing hold aloof from the soil, the more moderately wealthy will also avoid it; whereas, if our wealthiest citizens made it fashionable to take up some line of agriculture, moneyed men of less means would imitate, and the certain result would be improved methods and more ambition. In England and Scotland, and indeed in all the old lands, the tenant-farmer has many opportunities during the year of meeting on equal terms with his lordship of high degree who is engaged in farming in the vicinity. Even the Queen and the Prince of Wales are largely engaged in farming and pure-bred stock raising. In conclusion, I desire to say that no class of business men in the world have stood higher from a moral standpoint than the real breeders and importers of shorthorn cattle during the past fifty years. This has been so not only in Canada but also in the United States and Great Britain. It is much to say, but I believe it will not be contradicted. If we do not number in our ranks men of great wealth, we do number among us men of great ability and considerable influence, and I venture to say that in every neighbourhood in which they are found they will at least carry a full share of the respect and trust of the locality"

The following eloquent passage by Henry Howard Molyneux (4th Earl of Caernarvon) will appeal forcibly to the present generation of Australians. We reproduce it in the hope that it may stimulate the latter to emulate the indomitable courage and perseverance of their fathers:—

"What will be the character and tendencies of that young generation who have been born and brought up in Australia, and who know no other country or home? Whatever they may be, let no one deceive himself into the belief that they can be identical with their fathers, or with that earlier race who were, in very truth, the pioneers and makers of Australian civilisation. By vigour of intellect, by force of will, and by strength of limb they subdued the wilderness, hewed their way through trackless forests, and turned a rugged country into the rich land of promise it now is. They were giants; and unaided, and sometimes single-handed, they did their work with a thoroughness to which words can scarcely pay an adequate tribute. They had seen the rough sides of things, and—rightly or wrongly—they were not always content with the support which England gave her adventurous sons, who, in far-off lands, whence hardly an echo came back, and in hardship and danger, were planting great colonies and extending the distant bounds of the Empire; they sometimes murmured at the apparent forgetfulness; they often rebelled against what they deemed the interference and dictation of Downing street. But all this has passed away; the survivors of this brave race are now standing in the sunset of life, and amid the long shadows that are cast across their path, they condone past wrongs, they only remember the land of their birth with its manifold and tender associations, and they turn with almost passionate and pathetic fondness to their early home and the 'old country.' . . . Whatever may be the precise character of the political and official ties which in the future will exist, it would be treason to our best traditions to question the enduring affection which throughout all time will bind the Australian colonies and the Mother-country to each other."

THE MARYBOROUGH SHOW.

The Twenty-second Annual Exhibition of the Wide Bay and Burnett Pastoral and Agricultural Society was opened on the 2nd June by the Hon. A. J. Thynne, Minister for Agriculture.

Owing to the severe drought the exhibits were not so numerous, nor was the competition so keen, as on previous occasions. Still many of the exhibits were of sterling merit, especially in the cattle and horse sections. In the

farming and other kindred classes the Woowoonga district showed up well, Mr. O'Reilly's trophy being most creditable. Other exhibitors deserve great credit for the excellent samples of fruit, vegetables, butter, cheeses, and which afforded a good idea of the capabilities of the district.

THE LOCKYER SHOW.

The show of the Lockyer Agricultural and Industrial Association at Laidley was opened on the 17th June by His Excellency the Governor, and proved a very great success. The Hon. A. J. Thynne, Minister for Agriculture, was also present. His Excellency expressed himself as being very much pleased to be present on the occasion, and said that he took a deep interest in agricultural shows. The Hon. A. J. Thynne spoke *inter alia* of the Agricultural College at Gatton, and said he hoped it would be fully availed of by young and old, and he expressed a desire that farmers would show more of the element of organisation, which must ultimately lead to success.

The entries for blood stock were not numerous, but prizes were taken for stallions and mares, and were awarded to Messrs. S. Welch, W. H. Pitt, and J. Waters. The hackneys, especially ladies' hackneys, were very much in evidence.

The dairy section was well represented by some very fine Jersey and Ayrshire cattle. Good shorthorns and Herefords were also exhibited.

The entries of sheep were very limited, but this was compensated for by the exhibits of pigs, principally Berkshires, which were very good indeed. Numerous prizes were awarded in this section.

Despite the late dry season, now so happily passed away, the exhibits of farm produce were most creditable and of excellent quality; splendid samples of lucerne, oaten, wheaten, and panicum hay being shown.

The first prize for rye was awarded to Mr. J. Logan, junr. The judges must have had no light task in making their awards where most of the exhibits were of such excellent quality.

The poultry shown were very fine, especially the heavy varieties.

Some good hams and bacon were shown, as were good samples of homemade jams, pickles, bread, and cheese, the latter shown by the Model Dairy Company.

Mr. A. Philp had a splendid assortment of oranges and other fruits of the Citrus family. It is estimated that 2,000 people were present on the opening day.

AGRICULTURAL AND HORTICULTURAL SHOWS.

The Editor will be glad if the secretaries of Agricultural and other Societies will, as early as possible after the fixture of their respective shows, notify him of the date, and also of any change in date which may have been decided on.

SHOW FIXTURES.

Wellington Point Agricultural, Horticultural, and Industrial Association...	3 July
National Agricultural and Industrial Association of Queensland, Brisbane	10 August
Royal Agricultural Society, Toowoomba	4 August.

Farm and Garden Notes for July.

As a general rule and with a fairly good season the field operations for the month will consist of preparing the land for the maize and potato crops, and continuing sowings of oats, barley, rye, &c. Prairie and other grasses may still be sown if this has not already been done in March and April. In suitable localities early potatoes may be planted. Rice may also be sown during this month.

In the Kitchen Garden full sowings may be made of cabbage, carrot, broad beans, peas, lettuce, radish, onions, beetroot, eschalots, parsnips, &c. Rhubarb, asparagus, and artichokes should be planted out.

In the Flower Garden there is plenty of work to be done in thinning out and replanting misses in the beds sown and planted out during the past two months. Roses may still be planted. Sow everlastings, annuals, larkspur, antirrhinum, dianthus, cosmia, chrysanthemum, tricolour, petunia, coreopsis, &c.

In the Orchard, grape vines and fruit trees should be planted, and growing trees should be well washed with a good strong compound, as a preventive against disease. Also prune all fruit trees, including vines, if not already done in June.

Public Announcements.

THE *Queensland Agricultural Journal* will be sent free of cost to all agricultural societies, schools of art, local libraries, and country newspapers in the colony, and to agricultural newspapers and institutions of importance in other portions of the world. Secretaries of agricultural, horticultural, pastoral, and kindred societies in Queensland are invited to furnish the Department of Agriculture with information as to their respective membership in order that the necessary number of copies of the Journal may be supplied.

[CIRCULAR No. 1.]

The Queensland Agricultural College,

OPEN FOR THE RECEPTION OF STUDENTS, 1ST JULY, 1897.

EXAMINATION OF CANDIDATES, 30th JUNE, 1897.

THE College offers to Queensland youth a Direct Education in the Practice and Science of Farming. To carry out the intentions of the Government in this respect the School has been liberally equipped for its proposed work. This equipment (in part) embraces—

A Competent Staff of Teachers;
A Farm, consisting of 1,692 acres of land;
Five Commodious Buildings;
Dormitory Accommodation for 56 Students;
Three Breeds of Dairy Stock;
Implements, Apparatus, and Library.

Plans for a Commodious Chemical Laboratory and Lecture-room have already been approved by the Minister. This building, it is expected, will be ready for the use of Students of the Second Half-year.

FEES.—£25 per annum, payable half-yearly in advance, and a deposit of £1 as a guarantee against damage of buildings and furniture.

The Fee covers board, washing (not to exceed ten pieces weekly), room rent, and lights. Each room is furnished with bedstead, bed, pillows, chairs, and table. All other furnishings must be supplied by the Student.

LABOUR.—Students work one-half of the time, a day of labour alternating with one of study.

The Practical Work proposed for Students embraces, besides the care of Live Stock and the operations included in Tillage and Harvesting, Fencing, Clearing and Grubbing, Tile-Draining, and Construction of Farm Buildings.

COURSE OF STUDY.

FIRST HALF-YEAR—

Arithmetic	Botany
English Composition	Agriculture (Lectures).
Drawing	

SECOND HALF-YEAR—

Mensuration	Elementary Chemistry
English Composition	Agriculture and Horticulture (Lectures).
Drawing (Technical)	
Agricultural Botany	

Books and Stationery are supplied by the College at actual cost price.

NON-RESIDENT STUDENTS.—The Minister desires to encourage the attendance of Non-Resident Pupils, who are prepared to fulfil the College regulations in all other respects. The conditions of the admission of such Students to the privileges of the College may be learned upon application to the Principal.

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THE PRINCIPAL,

AGRICULTURAL COLLEGE,

GATTON.

THE QUEENSLAND AGRICULTURAL COLLEGE,
5th June, 1897.

By Authority: EDMUND GREGORY, Government Printer, William street, Brisbane.

THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. A. J. THYNNE, M.L.C.,

SECRETARY FOR AGRICULTURE.

VOL. I. PART 2.

AUGUST, 1897.

By Authority:

BRISBANE: EDMUND GREGORY, GOVERNMENT PRINTER.

1897.

CONTENTS.

The Agricultural Possibilities of Western Queensland.

By HENRY A. TARDENT,

Manager, Westbrook Experimental Farm.

THE work on the Experimental Farm being yet, so to say, in an incipient stage, the writer intends to dwell for the present on various crops which he has grown successfully for many years in the interior of the colony. But before entering into details about any special crop, he would like to offer the reader a general idea of farming in the West as it appeared to him during a somewhat lengthy residence there and after some reflection on the subject.

As is well known, Queensland is now just emerging from a rather severe and protracted drought, a circumstance standing somewhat in the way of a man trying to show the agricultural advantages of a region known to be possessed of a rather limited rainfall. Still, as Nature will not change her immutable laws to satisfy our desire—or our fancy—it is our duty to try and do our best with what she has given us. In that respect it may be of some use to see whether, perhaps, other nations have not been elsewhere placed in circumstances somewhat similar to ours. Their example may be either an *inducement* or a *warning* to us. From many examples supplied by history, none perhaps is more striking than that of the United States of America. Those acquainted with the history and economical circumstances of the North American continent tell us that for many score of years it was thought there that agriculture could be carried on successfully only on the eastern slope of the continent. The centre and west were a desert, the undisputed abode of the Indian tribes and of a few scattered pelt-hunters. Yet there came a time when that energetic and enterprising mixture of all nations, known as the *Yankee*, felt a desire to explore that west, to settle on it, and to see whether there was not perchance something in it. Numerous were the warnings given to intended emigrants. The Indian tribes were hostile and warlike, the droughts frequent and protracted, the winters abnormally long and severe, the land not seldom poor and shallow, and the markets for produce—nowhere! Still they went on. What were their motives, it is difficult to say; but it seems there is in human nature, as well as in certain species of the animal kingdom, a kind of instinct pushing them on at certain times irresistibly in a certain direction. Of course many were ruined, many became a prey to disease, others died from fatigue and exhaustion, others, again, fell under the arrows and bullets of the Indians. Thus was made a kind of natural selection, which left only the fittest alive—the fittest, who went on like an invading army and fulfilled to the letter the divine commandment, "Conquer the earth and subdue it." And now, after less than a century has elapsed, what do we see? The greatest agricultural centres of the United States are no more on the coast. They are in the west, in the very heart of the continent. The western farmer has called science to his help; he has dotted the whole country with agricultural colleges and experimental farms. The old obsolete ways of tilling the soil he has replaced with improved machinery and implements which have increased 100 and sometimes 1,000 fold his working power. He has made provision against the droughts; he has made provision against the protracted winters; and last, but by no means least, he has created his own markets by giving birth to such immense cities as Denver, Salt Lake City (Utah), Chicago, &c.; and now we may safely say that the whole world, including Australia, is to a certain extent his market.

Although the profession of a prophet is usually a dangerous one, the writer has little hesitation in saying that there are many signs announcing the eve of a similar rush towards the Western regions of Queensland—not that it be intended to depreciate in the least the North or the Eastern coast-lands. Those parts of the colony have advantages of their own which are probably unsurpassed in the world, and their agricultural future is certainly a bright one. But it is the deep conviction of the author that the West—at least where the rainfall varies between 18 and 30 inches—the West, with its fine, friable, loamy soils, so admirably adapted to stand a drought—with its well-marked seasons, its genial and invigorating climate—is equally as good for many branches of agriculture, and superior for some others.

Of course there, as well as elsewhere, there are successful farmers, and also many who are not. The failures of these latter are sometimes attributable to want of knowledge and experience, to shortcomings in moral or intellectual attainments, but more often to the want of working capital, which puts them at the mercy of a bad season or the usurious money-lender.

Amongst the branches of agriculture most likely to succeed in the West, the following are mentioned, although they by no means exhaust all the possibilities of future development:—

The sheep farmer is likely to remain for many years to come the king of the West. By this is not meant here sheep-farming on large estates which had its days of usefulness and its *raison d'être,* but is bound to be gradually superseded by closer settlement. What is meant is sheep-farming as carrried on by grazing farmers on areas varying from 1,000 to 10,000 acres. If the sheep farmer does not exceed the length of his working capital, if he is careful not to overstock or otherwise ill-use his paddocks, if he maintains a high standard of breed and . . makes a small provision of fodder to carry him through an occasional drought, he is sure to succeed. He has a secure and reliable market for both his wool and his meat. He is also usually well placed to supplement his income with *wheat-growing* which, to be profitable, must be carrried on on rather large areas and with modern labour-saving implements. Wheat, being not exacting as regards moisture, does admirably in the West, where it is usually of a high quality and yields a good keeping flour. The sorts to be grown, though, must be selected from the early-maturing rust resisting or escaping varieties; they must be sown early on well-prepared land. If they make too much headway, as sometimes happens in a mild autumn or winter, let them be kept in check by having them eaten down by sheep. These will act at the same time as a roller, and as perfect manure producing and distributing machines. Then in the spring, the wheat being well-rooted, makes a rapid growth with the least shower, and is ready for the harvester before the usual November storm rains set in.

Dairying, combined with pig-raising, has also a great future in the West, and is certain to ensure ere long a competency to thousands and thousands of farmers there. These latter, though, must be probably well convinced that dairying cannot be made profitable unless carried on in accordance with modern scientific methods and with implements and machinery obtainable only through co-operation of farmers amongst themselves. New breeds of *real* milch cows must also be introduced. They must be looked for, it is believed, in the direction of the Ayrshires and shorthorns. Such cows are hardy and profitable. They would pay the farmer for his trouble and labour, instead of ruining him, as do at present the miserable scrubbers to be found in many places. Housing in winter is also absolutely necessary. A single frosty night (and there are many such during our three months' winter) costs the careless farmer from 50 to 80 per cent. of his milk supply. No less indispensable is the growing of artificial fodder. Without the above three conditions being fulfilled to the letter, it is useless to go in for dairying. But if they are observed, there are few countries in the world so well adapted for successful dairying as Western Queensland. The natural grasses and herbages are there exceptionally rich and nutritious; but they not seldom fail, at the very time when they are most wanted

by the dairyman. But how easy it is to supplement them with cultivated fodders. There, not only can ample provisions of hay and ensilage be made for any emergency, but green fodder can be had the whole year through. Instead of the five or six months of winter and snow of the North American farmer, the Western Queenslander can grow, the whole winter through, wheat, oats, barley, rape, cabbages, sugar and silver beets, mangel-wurzels, prairie grass, &c.; and in summer, maize, Kaffir corn, Jerusalem and Himalaya corns, sorghum, pearl and broom millets, imphee or farmers' friend, *Setaria germanica* or panicum (of this latter he may take three crops off the same land in a summer, if he chooses to do so), and, above all these, sweet potatoes, the vines and tubers of which are amongst the best things a farmer can grow for himself, and for his cattle, horses, and pigs.

In regard to pigs, space does not allow the writer to express to-day all the good things he thinks of that most useful and most calumniated animal. True, the pig is somewhat of a materialist; he likes a good dinner six times a day—without whisky, though. But he is such a genial, good fellow; so thankful for the care bestowed upon him; so fond of a good bath and cleanliness when available to him; and above all he is such a magnificent money-coining machine. Through him all the products, nay, all the waste, of the farm can be turned into a currency in demand in all the markets of the world.

There are also in the whole of the West numerous and extensive areas of scrub and other lands perfectly adapted for poultry-farming, bee-keeping, fruit-growing, and especially vine-growing. If it is not the fatherland, it is at least the favourite adopted country of the vine, the crop of which has never been known to fail during the quarter of a century of its cultivation there.

There are, of course, some drawbacks there, too, and it is well that it be so. History shows us that the great nations of the world are not those living in countries where Nature pours her gifts on man without requiring from him some exertion in return. It might even be remarked that the climatic conditions are here so much more favourable, the soils so much more fertile, communications so much easier, and social security and order so superior to what they were in the early days of the American colonisation of the west, that it is a question whether the healthy principle of the survival of the fittest will be rigidly applied. It may be feared that many weaklings will survive, who, in all justice, ought to have been weeded out. In any case, there are hardly any drawbacks which could not be overcome by co-operation and combination amongst farmers themselves.

And let it be remarked, in conclusion, that the West of Queensland has no more than the East or the North of the colony to fear the effects of impending federation and intercolonial freetrade. All the above enumerated products are eminently fit for exportation as well as for home consumption. Whilst not a single Queensland farmer will go to the southern colonies, thousands will come here from the south. They will avail themselves of the virgin nature and greater fertility of our soils, of the comparative earliness of our seasons, of the immense extent and variety of our territory, and, let it be hoped, of the very liberal terms of our land laws. They will not only grow here with us the products necessary for the consumption of Queensland and Australia, but, working with us hand in hand, they will help us to force our way into the markets of the world, and take there a footing undreamed of at present by the most sanguine Queenslanders.

Maize-growing on Scrub Lands.

By A. J. BOYD,

Queensland Agricultural Department.

Many enterprising farmers from the southern colonies have of late arrived in Queensland, some of whom have, in addition to taking up wheat lands in the West, also purchased homesteads on the coast. These gentlemen are at once face to face with conditions of climate and cultivation to which they are strangers. One Victorian, who has made his home in Queensland lately under these circumstances, said:—"Wheat-growing I have been brought up to. I know how to manage on the Western country, but here, in this scrub land, is where I am at sea. Here is where I want instruction in clearing, in growing maize, sugar-cane, arrowroot, pineapples, &c., and here is where the value of your Department of Agriculture comes in." It is with a view to assisting the new-comer to start properly, and to manage properly, a scrub farm that I give these hints, which are the result of many years' experience, gained especially in the early days of rough farming in Queensland.

Maize is one of the most favoured crops of the South-eastern and South-western farmer. Go where you will, from the Tweed River to Rockhampton, thence to the Main Range to Toowoomba, Warwick, Texas, and back to the Tweed by Killarney, Dugandan, &c.—everywhere maize is king, except, of course, in districts entirely devoted to wheat and other like cereals. It may be taken that about one-third of the cultivated land in Queensland is under "corn," by which term maize is always understood; and when not under corn, much of it is temporarily occupied by that other great stand-by of the Queensland farmer—potatoes.

However, in this paper I propose to deal with the former crop alone, with a word or two, however, about pumpkins, which are inseparately connected with a maize crop.

SCRUB LAND AND HOW TO DEAL WITH IT.

Scrub land and the methods of dealing with it are the same to-day as they were forty years ago. There is no royal road to taking a crop out of it. It must be handled to-day as it was handled by the first settler.

Naturally the first work to be done is to get rid of the timber as fast as possible. One would suppose that there is no insuperable difficulty in doing this, given a few able-bodied men not afraid of hard work; but even in the simple business of felling the scrub timber, a man may make such mistakes as will lead him into considerable expense and, perhaps, cause him to lose a whole season.

Scrub lands are not all of the same character. Some are densely timbered; the trees bound together with vines (lianas) in such a manner that even when a considerable area is cut through not a tree will fall. Add to this a dense undergrowth of smaller trees, shrubs, and clinging vines (lawyers), large clumps of wild bananas, palms, &c., as in our Northern scrubs, and it will be plain that a certain amount of skill and experience are necessary to clear away the tangled mass and bring it under cultivation.

Again, there are scrubs which contain a quantity of most valuable timber—such as cedar, beech, hoop pine, kauri pine, yellow-wood, &c. Such are the scrubs of the Blackall Range, the Rosewood, and those yet standing on the high lands forming the watersheds of the Southern rivers—the Logan, Albert,

Pimpama, Coomera, and Nerang. Then we find scrubs such as those on the hills between Laidley and Gatton. These are usually of a light character, not much bound together by vines, and more easily cleared. Brigalow scrubs are found inland, consisting almost entirely of this kind of timber.

To return to the subject of clearing. Obviously it would be unwise to destroy the valuable timber above mentioned. There is always a market for cedar, pine, beech, and hardwood, not only in Brisbane but in other centres of population. Hence men are always to be found who are prepared to take the timber off the settlers' hands at a price which varies according to distance from market, difficulty or ease of access to rail or water carriage, and to the market demand and price. The settler may prefer to undertake this work himself, but he will find that, with all the other work he has to do to prepare his land for cultivation, the most profitable method for him will be to sell the standing timber outright to those who make a business of timber-getting.

To fell scrub properly, it is well to select a time when the sap is down, and this occurs about the winter months. Scrub timber felled at this time will dry quicker, and consequently burn off easier and more thoroughly, than if felled when the trees are full of sap, although even this difficulty may be got over by judicious felling.

It is a common thing for scrub farmers to cut half through a number of small trees, and then to drop a large tree on top of them. When the large tree falls, it naturally brings down all the smaller ones with it. But mark the result. The small trees, which were only half-cut through, are not detached from the stump. A strip of timber and the bark of one side still form a connection with the roots, and the sap consequently continues to flow; and the tree, although felled, remains green, and of course will not burn for months, and probably not at all till it has been handled a second time. "The longest way round is the shortest way home" is an old and a very good adage, and it applies to this case. By the method mentioned, the trees will no doubt be far quicker felled; but when we come to the clearing of it off the ground, then it is that we find out the mistake. But then it is too late—the mischief is done, and we can only make the best of it.

To fell scrub properly, the first thing to do is to "scrub" it—that is, to go through it with an axe or tomahawk or bill (with a long handle), and cut down all the small trees, saplings, and shrubs under six inches in diameter, taking care to lay them flat by lopping any branches sticking up; and at the same time (in a vine scrub) all the vines, lawyer-canes, and other creeping vegetation must be cut to the ground and cleared away from around the larger trees. After this is done, we may proceed to deal with the large timber and drop it on top of the already partly dried small stuff. Every tree, as it is felled, should be lopped as to its branches, and the whole laid as flat as possible. In proceeding in this manner, we are simply carrying out on a large scale the principle of building a small fire. The small dry stuff lies below, the larger limbs above, and the heavy trunks above all.

Should the scrub contain many bottle-trees or stinging-trees, some trouble arises, as these trees are very large and pulpy, and contain such an enormous mass of moisture that they will not readily burn. My plan was to split up the nettle-trees, and allow the bottle-trees to rot on the ground, which they do very rapidly.

Now we may attend to some other work, such as building a temporary dwelling-house or splitting fencing stuff, until the felled scrub is dry enough to burn off. This should occur in from six to eight weeks, according to the state of the weather. The best time to burn is at night, if there is a nice breeze blowing. I should have mentioned that the burn-off must not be deferred until the leaves have all dropped off the limbs. Should this have happened, a bad burn is almost sure to be the result.

Fire should be applied at several points at once, for it is a well-known fact that a large fire always creates a draught, and this materially helps to a good burn-off. If the timber has been well lopped, has lain a sufficiently long time,

and a suitable day chosen for firing, it will be found that a clean sweep will have been made of all the fallen timber, a few of the largest logs alone being left. These, however, will present no obstacle to subsequent planting operations, and will be easily got rid of by-and-by.

If the burn has taken place by the end of August, or indeed at any time between that month and the end of December, corn-planting can be at once proceeded with. There will be no weeds to clear away—the land presents to the view only a vast array of charred stumps and blackened ground, relieved by numerous patches of white ashes, still further increasing the richness of the fertile soil; but the ashes should be spread over the ground, and not left in heaps, to utilise them to the best advantage.

SOWING THE SEED.

Although the soil is apparently a mass of roots, these are easily cut through with a No. 3 hoe. It is always an advantage to sow corn in straight lines. On plain or forest land it cheapens and facilitates subsequent cultivation, whilst on new scrub lands it permits of free access of sun and air to each stool of plants.

Farmers differ in their opinion as to the distance at which corn should be planted. Some plant at 4 feet between the rows and 3 feet between the stools; others, 5 by 3; others, again, 6 by 3; whilst some give 6 feet between the rows and sow the seed continuously. The latter maintain that a greater yield is ensured by this system. In the United States of America most careful experiments have been made with a view to settling this point, and the results of a large number of tests go to show that the wider planting gives the greater yield. My own experience has been that 6 by 3 is the distance at which corn should be planted to give the best results. In 1863 I took 78 bushels per acre off a 10-acre patch of newly burnt-off scrub land at Oxley Creek; and I believe that my neighbour, Mr. Amos Radcliffe, who still works the farm adjoining mine, exceeded this return. On this occasion there were two fully developed cobs and often three on each stalk. When I tried closer planting, the yield was far less.

As I said before, corn should be planted in straight lines, even on new scrub land full of stumps. To accomplish this, the planter must have some guide through the maze of stumps. A stick with a piece of white paper or rag on top should be placed in the ground at a distance of about fifty yards from the starting point, and another fifty yards further on; then the planter, by raising his hoe as he advances in a line with the stick, can manage to keep a fairly straight line. The No. 3 hoe should be used, as it will cut through most of the roots, and will not easily break at the eye (a common trouble with hoes roughly used by the men) even with a stiff wrench.

The seed is carried in a canvas bag with a wide mouth, slung round the waist. One blow of the hoe is sufficient to make the necessary hole, into which from three to five seeds are dropped, according to the soundness of the grain. A backward, pushing motion of the hoe covers the seed, and the planter then advances far enough to plant one foot on the last hole planted. This pressure will not harden the surface soil on virgin ground; on the contrary, it just gives the pressure required to settle the soil over the seed. This regular advance brings him to the proper distance at which to make the next hole. The seed is again dropped, and so the process goes on till the whole field is planted. At intervals of, say, twenty or thirty feet, pumpkin seeds are dropped in the same line as the corn. Now

A WORD ABOUT SEED CORN.

It has always been the custom with corn-growers to select the large flat grains for seed. There can be no doubt that if the round grains are sown the crop will turn out a poor one. I have made experiments with these round grains, and invariably the cobs have not filled properly. But there is one point in connection with seed corn which is perhaps not generally known; and that

is, that the largest grains do not always necessarily produce a large plant. The size of the embryo plant within the seed bears no relation to the size of the grain. Of course, it can well be understood that the larger the seed, the more food material there is to enable the plant to resist adverse influences, and to enable the embryo to push its way up from a depth which would be fatal to a weaker germ. In this opinion I am borne out by the Agricultural Research Association of Aberdeen.

In 1896 the work done by that association was concerned chiefly with the cultivation of oats and the grass-crop. With regard to the "dressing" or selection of oats for seed, the report says:—"It has been proved by experiment that, contrary to what might have been anticipated, large seeds afford no ground for expectation of the production of large ultimate plants or heavier crops, nor do they secure any earlier germination. What they do secure is, power to reach the surface though deeply deposited, and a stronger briard, which will enable the plants to withstand uncongenial conditions of soil or season at the early stage of growth. The subject was followed up, and it was found, by investigation, that the size and strength of the embryo plant within the seed does not bear any relation to the size of the seed; small seeds may often contain larger or stronger embryos than a large seed."

The pumpkins being sown, two crops are now underway. When the corn is pulled, the pumpkins will be seen lying in tons upon the ground. So prolific are these latter in a favourable season that I have known a farmer at Laidley offer them for 10s. a ton merely to get them removed to enable him to clean up his ground. The seed being sown, nothing now remains to be done for the next four or five months, as the weeds will not grow, or at least do not germinate, if they reach the ground, on newly burnt-off scrub, so that no cultivation is required. Towards the end of that time, native currants and native gooseberries may make their appearance. The latter are of commercial value, and are always saleable at a remunerative price to fruiterers. They make delicious jam and puddings. Again, then, the farmer is at liberty to carry on any other work he may deem necessary, more particularly fencing, which should be completed before the crop is above ground.

In a favourable season, on such soil as I have described, the corn grows with marvellous rapidity, and will throw out suckers here and there, which should be removed. The labour is not great, and the suckers provide good green fodder for cattle, horses, and pigs.

Just before the stalk begins to turn yellow, the tops may be cut off just above the cob, for additional fodder. This will not injure the crop, as the pollen from the flower-head has long ago performed its duty by fecundating the tassel of the cob, which now requires no more nourishment from it.

Corn should be pulled on dry days, and not until the grain has set hard enough to resist the pressure of the thumb-nail. This test applies also to pumpkins, whose ripeness may further be ascertained by noticing that the curl at the stalk is withered.

Should continuous wet weather occur when the corn is ripe, it is a good plan to bend down all cobs which are still upright. As a rule, they hang downwards when thoroughly ripe, and this allows the rain to run off.

If they remain upright the upper grains will begin to shoot, and so much grain is lost or at best only fit to be fed to pigs.

When the corn is safely in the barn, every spare moment should be devoted to husking it. After husking, it should be left some few days to dry thoroughly, for the drier it is, the better it will thresh. The husks should not be burned, as they make very good bedding for man and beast. An excellent comfortable mattress can be made of them by first cutting off the dry knobby stalk, and then shredding the softer leaves or husks with a three-pronged dinner-fork. When these shredded leaves are put into a bed-ticking, a better or softer bed could not be desired.

The corn has now to be threshed. There is no need to describe the threshing-machine, as it will explain itself as soon as it is used. There is a

machine invented which husks, threshes, winnows, and bags the corn at once, but these are not in general use on farms. Objections to their use are three-fold: The first is, that as the cob is thrown in unhusked it is impossible to know whether it is mouldy or otherwise damaged; secondly, small cobs are not perfectly cleaned; and lastly, as there is no regulator attached to the machine, it can only take cobs of a certain size, and very large cobs jam in the feeder. The winnowing is done with an ordinary sieve. In order to get a uniform grain, it is well to break off the extreme top of the cob before threshing, as this contains only small grains, mostly ill-formed.

The threshed grain should now remain as long as possible in an airy barn before bagging, so that it may become thoroughly dry. If it be at all damp it will heat in the bags, turn black, and become unsaleable. When bagged, each bag should contain about 4 bushels of 56 lb. each.

When the crop is off, the cornstalks (if they have not been treated in the manner described and shown experimentally by Professor Shelton at the Gatton Agricultural College—*i.e.*, stooked after being cut, without pulling the cobs) must be cut down with the hoe, forked together, and heaped up against the logs which may have been left after the burn-off, and set fire to. Very little of the logs will be left after this. At the same time this is a wasteful procedure.

Another crop can now at once be put in; in fact, I have more than once sown the second crop before the first was pulled—in between the rows. This, of course, was in the warm coast districts. The second crop will come off before the frosts of winter, which generally occur from June to August. This year I put in a little corn as an experiment at the end of December, and a second lot at the end of March. The first ripened in April, and the second lot is now (June 30) in cob.

The second crop will probably require some hoeing, as weeds will now have begun to assert themselves. A light clipping hoe should be used for the purpose, but when the soil is stony a stronger tool is required. Some of the richest scrub lands are covered with surface stones, which give trouble in cultivation at first, but they are easily removed.

In my next paper I shall deal with the cultivation of crops other than maize, and with the removal of the formidable array of stumps.

The Velvet Bean.

The *Texas* (U.S.) *Stock and Farm Journal* contains the following very interesting article on a new bean, or, rather, a bean to which the attention of orchardists and agriculturists has only lately been drawn. The notice of the bean was written by a reliable public official in Louisiana, and may therefore be taken as correct.

"The Velvet Bean" (*Dolichos multiflores*), also called "Pea Banana," "Field Pea," and "Banana Stock Pea," has been cultivated in Florida for ornamental purposes, as trellises upon porches, and as shade for pine-apple patches. It has an enormous quantity of foliage and vine, and bears late in the season a large quantity of seed.

It is now used in orange groves instead of cow peas,* and several growers have found it very satisfactory. Dr. O. Clute, director of the Florida Experiment Station, had his attention called to this bean in 1895, and at once procured seeds, and began experimenting with it. The land was prepared as for corn, in rows three feet wide, and beans dropped one foot apart in drill. It was cultivated sufficiently to keep down weeds, with plough and hoe, until the vines shaded the ground. The ground finally became covered with a dense mass of vegetation. It bloomed in August, "producing long clusters or racemes of somewhat large purple flowers, which were quite ornamental. The bloom was followed by plump pods of rich dark-green, covered with a close down-like velvet, whence probably comes the name of Velvet Bean. At harvest, before frost in November (in Florida—Ed. *Q.A.J.*), a square rod of the vines and pods gave 93 lb. of green forage, or 16,680 lb. per acre."

He estimates that it would have cured into two or three tons of hay per acre. "All stock readily ate the green forage, including pods with beans."

Last year only five seeds of this bean were obtained by the writer. Of these two were planted around the front gallery, and one by the side of a small dead plum-tree. Those around the gallery became so rampant that the vines were many times cut back. They yielded a quantity of pods. The one seed around the plum-tree produced an enormous quantity of vines, completely obscuring the plum-tree, and in November one half-bushel of pods. The pods are thick and leathery, and very difficult to shell, each containing from three to five large, oval, plump beans, and are borne in clusters on a long stem. The vines grew over twenty feet in length. Left on the field, both leaves and pod were blackened by the frost, but the pods were apparently uninjured.

The Sugar Experiment Station is distributing these seeds, and will send to any applicant one pod, enough to obtain seed for a whole neighbourhood next year.

The vines have not been analysed, but Professor Persons, chemist of the Florida Station, has given the following analysis of the bean, air-dried :—

	Per cent.
Ash	2·29
Albumenoids	21·36
Fat	7·14
Fibre	8·46
Carbohydrates	60·75

* The cow pea is not recommended for orchards in Queensland by Mr. Benson, Government Fruit Expert.—Ed. *Q.A.J.*

The average of the cow pea, air-dried, is:—

	Per cent.
Ash	3·8
Albumenoids	24·3
Fat	1·7
Fibre	4·7
Carbohydrates	65·5

It is richer in fats and fibre than the cow pea; otherwise it compares favourably with it. No experiments have been made as to its digestibility, but doubtless it is not very different from that of the cow pea.

This bean is specially adapted to sandy soils, as has been repeatedly tested in Florida, and the very limited experiments there would justify the belief of its adaptability also to our alluvial soils. The shade, mulch, and fertilisation given by this bean should justify a more extensive use of it by our farmers. Larger experiments are being made with it this year at all three of the Louisiana Experiment Stations. Application has been made by the Queensland Department of Agriculture for seeds of the bean; and when experiments have been carried out with it, both as to its qualities as a fodder plant and as a manure, the results will be published for general information.

Choosing and Breeding Dairy Cattle.

By JOHN MAHON,
Government Dairy Expert.

At the present day it is the unanimous opinion of dairymen all over the world that the foundation of success in dairy-farming is dependent on skill and intelligence in selecting a good herd; and by giving this matter the attention it demands, the yield of milk is greatly increased, and the cost of production correspondingly reduced. It is not surprising to hear some dairymen in this colony express their dissatisfaction at the poor returns which they obtain from the dairy, when considering the small yield that is now being obtained from 75 per cent. of the herds in this colony. I estimate the annual yield at 70 lb. of butter per cow, which I consider could be increased by three times that amount if more attention were given to selecting, culling, and feeding the herds that are to be found in the various districts. The cost of feeding and milking three inferior animals which probably would only yield as much as one good one has rarely been considered by the Queensland dairymen. I think that the lack of attention on the part of the farmer in selecting good herds is to a great extent due to the low prices which a few years ago prevailed for dairy produce in our markets. These low prices were brought about during the summer months, when there was a surplus supply, &c., in cold storage. At the time referred to, dairymen only milked their herds when a reasonable price was obtainable, and as the prices became low the cows were turned out for the season; but now that an outlet is found for the surplus products there is more inducement offered to dairymen to build up a good herd. It is amusing to listen to the remarks, and to note the various opinions, expressed by men who consider themselves judges of dairy cattle, many of whom never milked a cow or placed a hand upon the udder of an animal. A person who is a judge of show-ring or beef qualities is rarely found to be a proficient in determining the milking capabilities of an animal. In selecting a dairy animal, we want more than a pedigree. At the present time some purebred animals are worthless as milk-producers, which is due to neglect on the part of the owner in not aiding the development of the milking propensities inherited from the parentage—*i.e.*, by carelessness in rearing the young, neglect in feeding the animal during lactation, not milking at a regular time, and allowing the cow to retain a portion of the back milk. A good judge of milking qualities is seldom wrong in his selection, especially after the animal has reached the age of two years. In choosing a herd, it is wise to gain as much knowledge about the ancestors as possible; in fact, as much attention should be given in this matter as in selecting a racehorse. In making a selection, be extremely careful as regards the digestive organs; where these are defective, good milkers are rarely, if ever, to be found. Experience has taught us that these organs have a great influence on the milk secretion; therefore this is one of the most essential points to be considered in a dairy beast. In all herds there are to be found two distinct types of cattle—the beef cow and the dairy cow. The former may be described as compact, thick-shouldered, thick-necked, with beefy thighs, well-ribbed, and straight-backed. A cow of this description will never make a milker, no matter how she is bred. The latter is the opposite in conformation.

The true type of a dairy cow may be described as follows, viz:—Fine hair, yellow oily skin; thin neck; thin sharp shoulders; flat thighs well apart, to make room for the udder; long hips; large chest capacity, for lung expansion; and the most essential of all is a deep flank with well-shaped udder running along the

belly and well up behind the thighs, free from any but fine hair, with milk veins visible and extending towards the armpit, the head long and broad between the eyes, large muzzle, with a clear eye, which indicates a strong constitution. Frederick Smith, M.R.C.V.S. L., V.S., Army Veterinary Department, Lecturer in Military Veterinary Hygiene in the Army Veterinary School (a great authority on veterinary physiology), in writing on milk secretion, states that the nervous system of the cow is intimately associated with the production of milk. Very heavy milkers, as a rule, show a more pronounced nervous temperament than do animals of the beef type that secrete very little milk. According to the best authorities, a nerve starts from the spinal cord at the lower part of the loins, and divides the pelvis into three branches. One branch is distributed among the muscles of the abdomen, while the other two are distributed through the udder. In this latter organ the nerves are divided, so that one branch is associated with the teat, another with the milk-cistern, while a third permeates the lobules and alveoli. As the teats are worked by the hands, the nerves become irritated, causing their contraction and the discharge of their contents. Animals noted as large milk-producers are usually found to have large arteries and veins connected with the udder. The larger veins extend along the belly towards the shoulder or armpit, while the smaller ones are twisted, and extend in no definite direction. These veins are a good guide for a person in selecting herds, and I would advise handling the udder before purchasing. The irregularity of form to be found in the cow's udder is not to be found in the anatomy of any other animal. I may here say that I favour no particular breed, as good and bad are to be found amongst all breeds, and the man who favours one breed is ignorant of all other breeds.

Individual cows, holding Australian records for butter production, are bred from shorthorn cows, by Ayrshire sires. This cross or strain is most in favour in Victoria and New Zealand at the present day. There is a distinct strain of shorthorns that are excellent milkers, but it is difficult to meet with them.

The purebred Ayrshire holds a high position among the best milkers at the present time, and can only be despised for her short teats, which causes the milking process to be rather tedious; but by crossing with a good milking strain the matter of short teats is overcome, and it has been proved beyond doubt that the Ayrshires have the power to transmit their good qualities to their offspring. Personal experience has taught me that a cross with an Ayrshire sire (from a good milking strain) and the shorthorn or ordinary cow will give good results. This cross or breed is within the reach of every dairyman in Queensland; but it must be borne in mind that the sire must be from a good milking strain. Best results are obtainable from matured sires which have the power to transmit their characteristics to their offspring with almost a degree of certainty. Another point in favour of the Ayrshires is that they are animals of strong constitution, are most suitable for our climate, and would do well in the Northern parts where climatic influence is more severe. Some people will argue that the Ayrshire is not a good butter cow, which is not so. This breed holds records up to 1,200 gallons of milk per year, with a butter yield of 550 lb.

The shorthorn is bred specially for beef, and is not adapted to all classes and conditions of treatment. It does very poorly on high, inferior country. This animal is large and heavy, and requires good food, and a quantity of it, to produce anything like a reasonable supply of milk. There is a distinct grade of shorthorns that are considered very good milkers; but the cost of feeding, compared with other breeds, is very great. I believe in America, at the present day, the shorthorn holds the highest records for butter production. There is one very great point in favour of the shorthorn—*i.e.*, if the female be mated with a good milking sire (the Ayrshire, Jersey, or Alderney), the best results are obtainable.

The Devons are fairly good dairy cattle, can withstand hardships, and do well on rough hilly country; they yield a good supply of milk, rich in butter fat, second only to the Jersey in this respect. I have seen some very fine

D.C.A. Bred by J. W. B. Amess, Esq., Riddell's Creek, Vic.
College Herd Bull (Ayrshire).

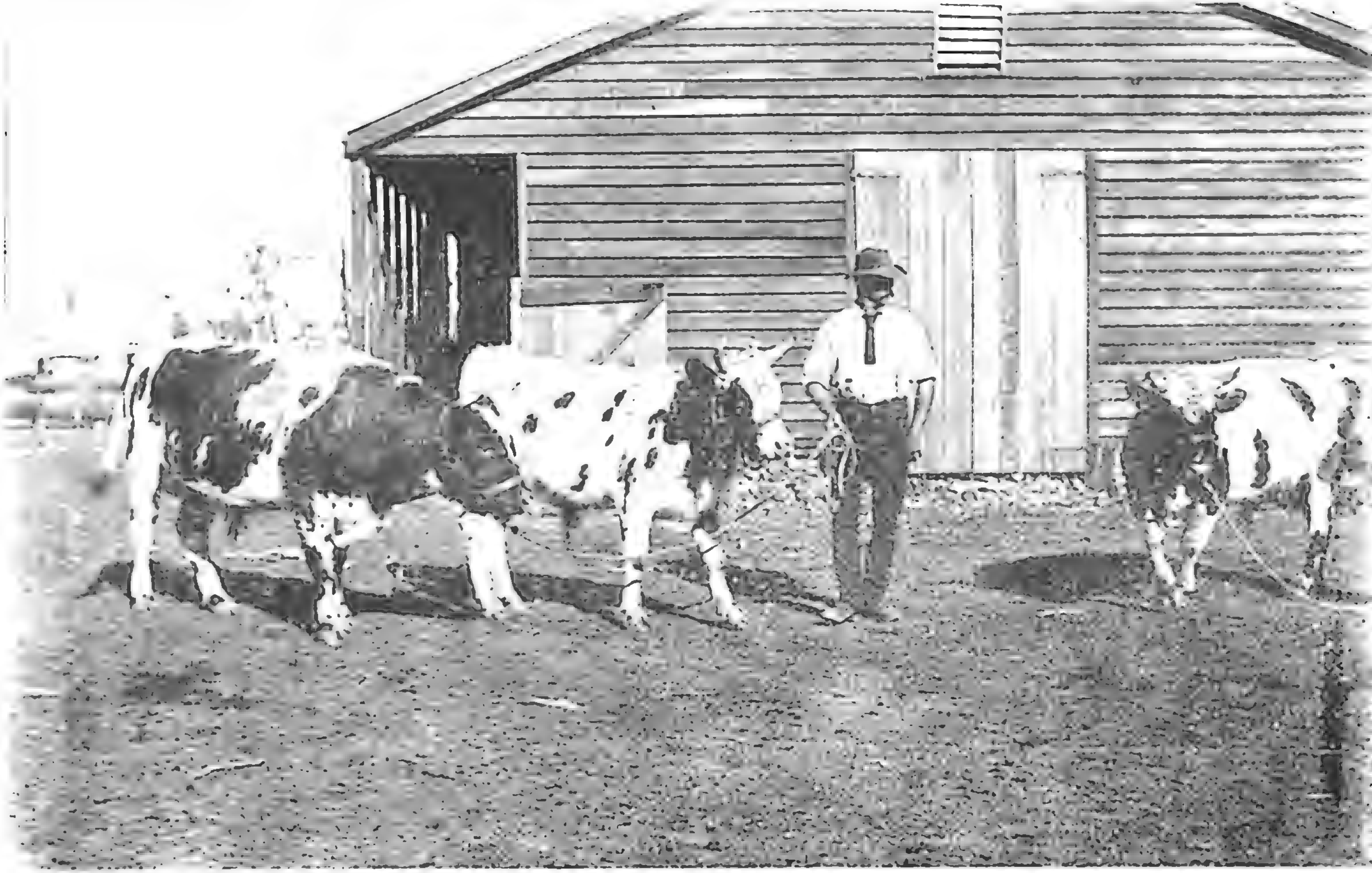
GORDON. Property of T. A. Grant. Esq., Vic.

Ayrshire Bull, Sire of College Heifer.

LAVINA. LENA OF GLEN ELGIN. LINNET OF GLEN ELGIN. ROSEBUD OF GLEN ELGIN.

Bred by T. A. Grant, Esq., Victoria.

College Dairy Heifers (Ayrshires).



GLEN ELGIN'S CHAUTER. BRUCE OF GLEN KER. BRUCE OF GLENCAIRN.

Bred by T. A, Grant, Esq., Vic. Bred by J. T. Burnit, Esq., Vic.

Ayrshire Bulls at the Gatton Agricultural College.

Devons amongst some of the herds in this colony, and these are considered by the dairymen to be superior to most other breeds. It must be remembered that the animals referred to were not bred for milk-producing. I have had no experience with the Devon cross, but I shall be pleased to have the experience of others on the matter.

The Holstein, or Dutch cattle, are the most wonderful milkers of the day, having records as high as 106·75 lb. of milk per day, yielding 3·22 lb. of butter fat. It has been found necessary to milk these large milk-producers thrice daily. One feature noticeable in the Holstein is, that the percentage of fat in the milk is low, as is the case with all animals yielding large quantities of milk. The Holsteins are of immense size, are very docile, and appear to know the purpose for which they are needed. These cattle do well on heavy flats, where there is plenty of pasture; they require plenty of feed, but do not forage much for it themselves. From knowledge gleaned elsewhere, I find this breed will cross well with the grade animal, and give good results; but it must be remembered that the Holstein will not stand rough usage, such as that bestowed upon the general run of herds in this colony. Such high value is placed on these cattle in Australia at the present day, that they are beyond the reach of many dairymen.

It is needless to say much about the Alderney or Jersey breeds, as their good qualities are well known by all who take an interest in the animal that produces the lacteal fluid; but one remark may be made as regards this class of animal, and that is, we have not had anything great in the way of butter production from them in Australia. Perhaps this is due to our not having the best strain of blood; and after inspecting an imported Jersey bull in Ipswich a few days ago, I am convinced that there is room for improvement in the best Jersey herds that I have seen in these colonies.

The Jerseys (as every experienced person knows) are a very delicate cattle, and, like the Holstein, require a great deal of care and attention, without which disappointment will be the result. The Jersey, if judiciously crossed with the ordinary cow, will give better results than the purebred, as (in my opinion) the thoroughbred could not withstand hardships and climatic influence.

It is a mistake to cross purebred stock; they should be kept distinct and pure. The different breeds have been crossed, and failures have resulted. But by crossing one or the other of the purebred type with the ordinary milker good results will accrue therefrom, especially when the pure blood comes from the sire's side.

In the next issue of the journal I will give a few hints on feeding and treatment of dairy cattle.

On the Development of a Dairy Breed from our Native Cattle.

By P. R. GORDON,

Chief Inspector of Stock.

It has long been a popular belief that food has a potent effect in increasing or diminishing the percentage of butter fat in the milk of cows; but recent experiments and observations have shown that there is only a modicum of truth in this. There can be no disputing the fact that generous feeding increases the flow of milk, and in thus far, the increase of butter fat will be in proportion to increased bulk of milk; but the most generous feeding has but a slender effect in increasing the percentage of butter fat. This was demonstrated by a series of carefully conducted experiments and observations at one of the State Agricultural Colleges in America, and afterwards corroborated by observations of practical dairymen in the west of Scotland. It is, therefore, a fact that the richness of milk depends on an inherent distinguishing property of breeds of cattle, and the same is, to a large extent, true as to quantity of milk yielded. Perhaps no better illustration of the above could be selected than the contrast between the Jersey and Ayrshire breeds of cattle. In the former, although the yield of milk is small by comparison, its quality is exceedingly rich. In the latter, the milk yield is great, while the percentage of butter fat is much below that of the Jersey. When dairymen have been brought to recognise the fact that quality of milk depends on the breed rather than on the food consumed, improvement in our dairy cattle will follow, almost as a matter of course. It is unnecessary to state that the shortest way to improve a dairy herd would be to build it up on well-known milk-producing breeds, such as the Ayrshire, Jersey, Guernsey, Holstein, or the south coast dairy cattle of New South Wales; but, removed as we are at so great a distance from the native habitats of these breeds, the establishment of a pure dairy herd, on either of these lines, would not only be costly, but would occupy a considerable portion of a man's lifetime. But, the question will naturally occur, whether we have not in our native cattle the nuclei of good dairy stock, requiring only skill and careful selection to evolve from our ordinary cattle a first-class dairy breed. It is well known that the shorthorn—or Durham—cattle, of which by far the larger proportion of our Australian herds are composed, were at one time one of the most valuable dairy breeds in the United Kingdom; and although they have for so many generations been bred purely for beef production, their milking properties thus allowed to become latent, still the dairy shorthorn at the present day more than holds its own against all other breeds in milking trials at the great London dairy shows. In our own colonies, many shorthorn cows are to be found fully equal to Ayrshires at the pail, and little behind the Jerseys in quality of milk. If careful selection of cows of our native cattle were made, and great care exercised in the selection of bulls of well-known milking strains, religiously weeding out all cows that did not come up to a certain standard, say sixteen quarts or 40 lb. of milk daily, in a few generations a valuable dairy breed of cattle would be developed. It should be carefully borne in mind that the bull is half the herd, and, therefore, the utmost care must be exercised in the selection of bulls. No bull should be admitted into a dairy herd unless its dam has been a known good milker, and its sire the progeny of a good milker.

This holds good even with bulls of recognised pure milking breeds. I may be permitted a digression here to remark on the caution necessary to be exercised in the selection of bulls that have made their mark in the show-ring. I am fully sensible of the fact that agricultural shows have done much to encourage improvement in live stock, and I have shown my appreciation of their usefulness by assisting in the establishment and working of several agricultural societies; but, like everything else, they have their abuses, and in no section of our agricultural shows has this been more clearly demonstrated than in the manner of adjudicating and making awards in the case of dairy stock. The mode of judging dairy stock, particularly pedigree cattle, almost universally adopted at agricultural shows, is by a system of exterior features or points; and, although that system answers exceedingly well with beef-producing cattle, it has been found inapplicable to dairy stock, and in many instances is so misleading, that a heifer that has been decorated with the highest show-yard honours has been found not equal at the pail to some animals procurable at less than one-tenth the cost, and which would have been deemed the veriest scrubbers in competition with the more aristocratic animals. This is no mere assertion; I have had personal experience of such instances. It may be taken as a maxim that a good milk cow usually shows good exterior points, but the converse does not always hold good. Many animals showing bad external points are superior milkers. The true test of a dairy cow is her performance at the pail. The truth of this was so borne in on Mr. Robertson, of Canada, the owner and manager of, perhaps, the most extensive dairy establishment in the world, that on his last visit to his native county—Ayr—to select fresh stock, he found amongst the celebrated prize-takers so many inferior milkers that he made his selections from among herds actually in use in dairies in that county and Dumfries, and which had not figured in any show rings. If a superior dairy herd is to be built up, no test other than that of the pail must be relied upon. To establish a dairy herd the best milking cows, *regardless of breed*, should be selected, and in making such a selection the following cardinal points should be kept in view:—SIZE: Anywhere between 600 to 2,000 lb. live weight, other things being equal. CONFORMATION: Large barrel and great capacity, as shown by deep middle, and ribs well sprung. Neck, shoulders, and thigh thin, wide over hips and loins, thin in flesh and lacking beef form when well fed; showing good health by having good heart and girth and smooth hair. As a general rule, a good milking cow should, when in full milk, yield at least her own weight in milk every month. No bull should be used whose dam does not come up to the above standard. After having secured the nucleus of a herd, all cows that do not come up to the minimum standard of daily yield should be weeded out, and this should be done by carefully weighing and recording on a slate hung up in the milking-shed the daily yield of each cow. At first the standard of excellence need not be fixed too high—say, twelve or fourteen quarts daily; but by careful selection in breeding, the yield will increase with each successive generation.

One great means of improving our dairy stock would be the recording of dairy cattle in district herd-books, adopting the principle which has done so much to improve the American trotting horse, regarding none as eligible for registration that did not come up to a certain minimum standard, and no bulls whose dams are not eligible for registration. Some such principle has been in operation among breeders of dairy stock in the south coast of New South Wales, and, no doubt, has been the means of rendering those cattle so justly celebrated for their milking properties.

There is an old aphorism that "much of the breeding goes in at the mouth." There is much truth in this, and although it may be more applicable to beef than to dairy breeds of cattle, still one of the greatest elements of success in the improvement of all classes of domestic animals has been a constant supply—without pampering—of healthful food; and therefore one of the first cares of breeders of dairy stock and dairymen ought to be the storage of food for winter supplies and for seasons of drought.

The Tick Trouble.

INOCULATION TESTS.—DR. HUNT'S EXPERIMENTS.—HIGHLY VALUABLE RESULTS.—A MOST INTERESTING REPORT.—INOCULATION AT GRACEMERE.

THE following is the latest progress report received by the Chief Inspector of Stock from Dr. J. S. Hunt, who is carrying on experiments with reference to tick fever in the vicinity of Hughenden:—

"In view of the desirability of obtaining definite evidence as to the safety and efficacy of inoculation with the blood of a recovered animal as a means of protecting cattle from tick fever, the following experiments, recently performed here, are, I venture to think, of sufficient interest to warrant their being at once communicated for the information of your Board.

"The experiments in question were designed to ascertain—

"1. The amount of immediate danger incurred in inoculating clean cattle with various quantities of blood from a recovered beast.

"2. The protective efficacy of such inoculations—(*a*) against virulent tick infection; (*b*) against injections of virulent blood from an acutely diseased beast.

"3. The protective efficacy of small daily doses of arsenic—(*a*) against virulent tick infection; (*b*) against injections of blood from an acutely diseased beast.

"It will be at once observed that these experiments, so far as inoculation with the blood of a recovered beast is concerned, are on the same lines as those instituted at Mundoolan. From the scientific standpoint they are decidedly inferior to the Mundoolan experiments, not only on account of the smaller numbers dealt with, but because the absolute cleanliness—past and present—of cattle within the infested area is always more or less open to question. On the other hand, from the purely practical point of view they are, I think, of considerable interest, because they were carried out under precisely those conditions in which protective treatment is mostly called for—namely, in the case of cattle yet unaffected with disease in the tick-infested areas, and cattle threatened on the borders of those areas. In neither of these cases can the absolute cleanliness of the cattle be assured, nor, so far as the interests of the owners of such stock is concerned, is this of any importance, because, whether perfectly clean or not, such cattle are certainly susceptible to the disease, and therefore require protection.

"It may perhaps be suggested that for experimental purposes—to determine the actual value of any given method of inoculation—the bare possibility of any of the cattle employed being partially or even wholly immune from some previous tick infection is an absolutely fatal objection to the validity of any deductions that might be drawn from such experiment. But as against this it must be remembered that all the cattle employed were of the same class, and drawn from the same locality; and even though a percentage of them might possibly have been partially or wholly immune, the error from this cause was equally distributed over the whole lot, and would not affect the comparative results as between those inoculated, those treated with arsenic, and those used as 'controls.'

"The conditions requisite for carrying out the proposed experiments were:—1. Clean cattle, or cattle from a locality where no disease had been. 2. An animal that was known to have had the disease and recovered (from

which to obtain the blood for the protective inoculations). 3. A virulently tick-infested paddock—*i.e.*, where susceptible cattle were known to succumb to the disease. 4. An acute case of tick fever (from which to obtain virulent blood wherewith eventually to test the efficacy of the protective inoculations).

"These conditions are not, I think, as a rule very difficult of attainment in the North. They were all present at Glendower, thirty miles from Hughenden, up the Flinders. And here by the kind courtesy of the owner, Mr. Robert Gray, and with the hearty co-operation and assistance of Mr. A. W. Ferguson, the manager, our experiments were carried out.

"The required bullocks were brought in for our use from the upper or clean end of the run, where neither ticks nor disease had been seen. It was proposed to inoculate ten, treat ten with arsenic, and use the remaining ten as 'controls.'

"On the 24th April ten bullocks were accordingly injected, behind the shoulder, with doses varying from one to ten cubic centimetres of defibrinated blood taken from a beast that had completely recovered from a severe attack of acute tick fever. Unfortunately two of these bullocks escaped into the bush the next day, and all that is known about them is that they were seen alive and apparently well some weeks afterwards. Eight bullocks, therefore, were actually employed in this experiment, and it was decided to use only a corresponding number of 'controls.' As a result of this inoculation most of the bullocks developed a certain amount of fever, in some cases reaching as high as 106·4 Fahr. on the seventh to the fourteenth day. The numbers employed were, however, too small to give any very reliable information as to the first object of the experiment—namely, to ascertain the amount of immediate danger to the cattle as the direct effect of the inoculation.

"On the same day that these inoculations were carried out, the ten bullocks to be treated with arsenic received their first dose. For the sake of accuracy of dosage and certainty of administration, the arsenic was given in weak solution by hypodermic injection. Each animal thus received daily during the first week one grain during the second two, and during a few days of the third week three grains of arsenic.

"All twenty-six animals subsequently depastured for five weeks on a virulently infected spot, and became duly tick-infested. They were tailed by day, yarded by night, and their temperature taken each morning at break of day. The results of this exposure to virulent tick infection were as follow:—

"Of the ten treated with arsenic, six contracted the fever, and three died.

"Of the eight 'controls,' two contracted the fever; none died.

"Of the eight inoculated, none contracted the fever.

"On the 29th May—exactly five weeks after the inoculation—all the surviving bullocks were subjected to a further test of an injection behind the shoulder of 20 c.cm. of virulent blood from an acute case of tick fever.

"The results of this second test were as follows:—

"Of the seven surviving bullocks treated with arsenic (three of which had already had the disease from tick infection), two contracted the fever, and both died.

"Of the eight 'controls' (two of which had already had the disease from tick infection), four contracted the disease; none died.

"Of the eight inoculated (none of which had suffered from tick infection), none had any rise in temperature whatever.

"It should be stated that such of the 'arsenic' and the 'control' bullocks as had suffered fever from exposure to the tick infection, were not in any case affected by the subsequent injection of virulent blood. Hence as the result of both tests it will be seen that—

"Of the ten treated with arsenic, 80 per cent. suffered from the fever.

"Of the eight 'controls,' 75 per cent.

"And of the inoculated, 0 per cent.

"If, as I confidently anticipate, these results are corroborated when the animals inoculated at Mundoolan are put to the test, it would seem only necessary to remark that the inoculation can be done without difficulty by any practical stockman, armed with a suitable syringe, and that the present cool season is a pre-eminently favourable time for inoculation. It should be stated in connection with these Glendower experiments that, by the generous and public-spirited action of Mr. Gray, it was arranged that only such animals as were actually destroyed should be charged to the Department. We are also indebted to him and to Mr. Ferguson for the amenities and conveniences of the station whilst the experiments were in progress.

"I have just received a letter from a practical cattleman, who watched our Glendower experiments very closely—with, I think, at first a little scepticism. He says: 'I certainly intend to inoculate the stud cattle, feeling my way carefully, and am now erecting yards at ——— for that purpose. If we could get rain and green grass, I would not hesitate a minute to put tick fever through all the studs with the exception of the cows that are in calf, and I feel sure the results 'would be satisfactory.'"

INOCULATION AT ROCKHAMPTON.

In a private letter to the Hon. A. J. Thynne, Secretary for Agriculture, Mr. Archer, of Gracemere Station, near Rockhampton, gives some highly interesting and important details of experiments carried out by him for the purpose of ascertaining the value of inoculation as a preventive against tick fever. With this view, Mr. Archer tried two remedies on four bullocks. One of them he inoculated with the blood taken from a beast which had recovered from an attack of tick fever, another with the blood of a beast suffering from a virulent form of the disease. The other two bullocks were not inoculated, being kept for control purposes. When the operations were complete, the four bullocks were put into a paddock badly infested with ticks. The result was, that first the two control animals died of the fever; then the bullock inoculated with the virulent blood got very sick, but eventually recovered; lastly, the animal which had been inoculated with the blood of the recovered bullock showed no symptom of the disease.

It will thus be seen that Mr. Pound's theory of inoculation *versus* dipping has been confirmed from two independent sources.

Fruit Culture in Queensland.

By ALBERT H. BENSON,
Government Fruit Expert.

In the previous part of this paper the importance of selecting a suitable soil, site, and shelter for the orchard was pointed out, and particular emphasis was placed on the fact that, in order for fruit culture in Queensland to be a commercial success, it must be carried out on the most approved lines and under the most favourable conditions, and that no fruits should be grown on an extensive scale unless they are thoroughly adapted to the soil, climate, or district in which they are planted. A maxim in fruit culture is to grow in your soil and district only those fruits which you can grow to perfection and at a minimum of cost, and to let others grow those varieties that they can grow better and cheaper than you. The intending fruit-grower having now selected a site for his orchard having the necessary qualifications of suitable soil, shelter, situation, and accessibility to markets or good facilities for transporting the crop when grown, the next consideration is—

THE PREPARATION OF THE LAND.

There is an old adage to the effect that, if it does not pay to do a thing well it certainly will not pay if done badly. This is especially applicable to fruit culture, particularly so in the preparation of the land for an orchard, as it is impossible to prepare the land too well. Remember that planting an orchard is not like planting a field of wheat or any other ordinary farm crop that only occupies the land for a few months, but that an orchard once planted and properly cared for will last many years, if not a lifetime; and that, if the preparation of the land has been neglected in the first place, there is no opportunity of making it good once the trees are established.

The first operation in the preparation of the land for an orchard, if the site chosen is virgin forest or other uncleared land other than scrub, is to clear it; and whatever system of clearing is adopted, it should be a thorough one, and all stumps and roots should be taken out to a depth of 18 inches to 2 feet. In the case of scrub land, however, this is neither necessary nor desirable, as it would be a very expensive undertaking; the better plan being to fell all undergrowth and timber, burn this off when dry, and then plant bananas, sugar-cane, or corn (maize)—according to locality— between the stumps, which will rapidly rot out, so that they can be easily and cheap.y removed in the course of three or four years. The crops grown on the land will have tended to sweeten it; and as many scrub soils are of extreme richness, they are all the better for being somewhat reduced, as excessive richness in the soil is apt to produce an abnormal growth in all fruit trees planted in it, and this abnormal growth is not, as a rule, conducive to the production of high-class fruit.

With forest land it is a great advantage to have had the timber ringbarked for some years before clearing, as this tends to sweeten the land and greatly reduces the cost of clearing; but where this is impracticable, no suitable ringbarked land being available, then the clearing should be done some months before the land is required for planting. Where the timber is small, it may be cleared most economically by means of a forest devil or by a good team of bullocks. Even where the trees are of fair size, say up to three or four feet in diameter at the base, they can be easily pulled down by a good team of bullocks, provided that the ground is well opened up round the base and the

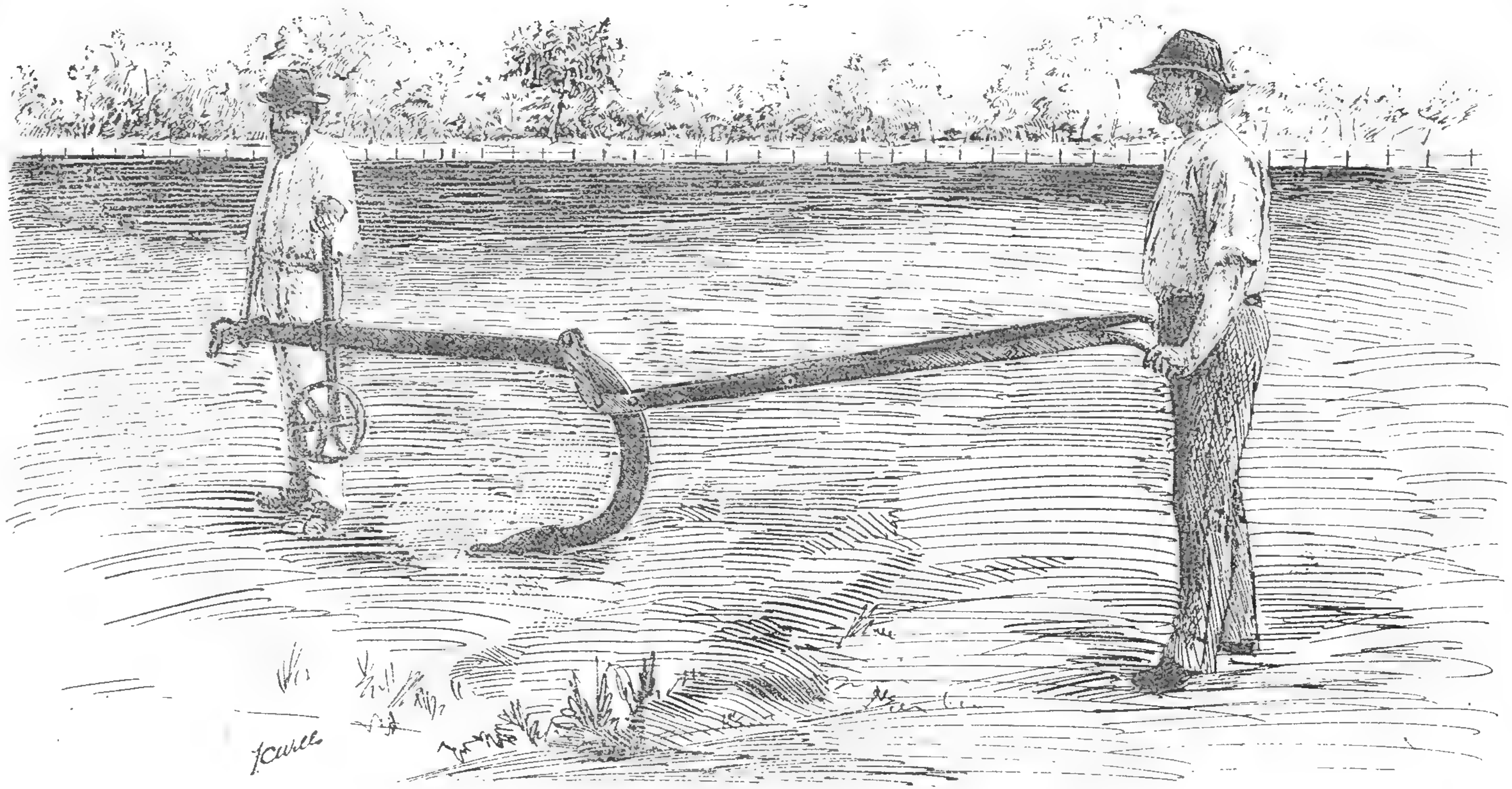
large roots cut, also that the tree is well dug under on one side. To pull down trees with bullocks, all that is required is a strong wire rope of sufficient length for the team to be clear of the tree when it falls. One end of this rope is made fast to the tree as high up as possible, and the other is fastened to a heavy log, to the other end of which the bullocks are hitched. The bullocks keep a steady strain on the log, and the tree is pulled down. The roots should be then run, timber suitable for fencing should be saved, and the balance either burnt off or, where required for fuel, cut into suitable lengths and carted off. When burning off do not make too large fires, as if so the land is apt to be injured by the extreme heat; and when the timber is burnt see that the ashes are spread over the land, and not allowed to remain in great masses where they will do more harm than good.

For taking out large stumps or any very heavy timber, the best and cheapest method of clearing is by means of powder, as large stumps can be easily blown up or so shattered that they will burn readily if a good charge of powder is placed well down in the main root or well into the solid part at the base of the stump. Very heavy timber also burns off much more readily if shattered by one or two charges of powder. Clearing with powder is largely carried out in the case of heavy timber in California, and it is found to be much the most economical process, and I recently met a fruit-grower near Woombye who had used powder with marked success in clearing heavy forest country. Never burn any really good timber if you can possibly help it, as the time is coming when we shall want those timbers which are now destroyed annually to the extent of many millions of feet. As soon as cleared, the land is ready for breaking up, and if the clearing is well done and the roots well run the land should be ploughed with a good single-furrow breaking plough as deeply as the nature of the soil will permit, but in no case should the subsoil be brought to the surface. The breaking plough should be followed by a powerful subsoil plough, such as shown in the accompanying illustrations, and which is being used at the Hermitage and Westbrook Experiment Farms. The subsoiler shown is Brisbane-made, costs £7, is very strong, does excellent work, is not easily broken, and will break up the subsoil to a depth of 16 to 20 inches from the surface. Preparing the land in this manner acts, in a great measure, the same as if the land was trenched by hand, and the cost does not exceed £2 10s. per acre. Subsoiling tends to break up any hard pan; it warms, drains, and aerates the subsoil, renders its plant food available for the trees' use, and increases the capacity of the soil for retaining moisture—a very great consideration in this colony on account of the long periods of dry weather and the excessive surface evaporation during hot dry spells.

The breaking ploughs that are used should be strong, and should turn the soil right over, not stand it on edge. The ground should be left as rough as possible, and if it can be managed it should be left exposed to the full action of the weather for some months before planting, as this will tend to sweeten the soil, liberate plant food, and to make it more friable and easily worked. The land should be then well harrowed with heavy breaking harrows, so as to thoroughly break up any sod in the original furrows. It should next be cross-ploughed and worked down fine, all roots or stumps met with in the various workings being burnt, and any rocks being taken out and carted off. If the surface of the land intended for the orchard is very uneven, then it should be graded or levelled before planting; and if it is intended to irrigate the orchard, then this grading must be very carefully carried out. When dealing with orchard irrigation later on, I will go fully into the question of grading, and will endeavour to show how it may be most cheaply and accurately done. Always prepare the land thoroughly, and it will be found that the extra care devoted to careful preparation will pay handsomely in the end, as the trees will get a better start, thrive better, come into bearing earlier, and produce more and better fruit than when little or no care has been taken. Never plant any fruit trees on raw, sour, or badly drained land, but see that the land is thoroughly sweetened and brought into a fine state of tilth before planting.

Preparing Orchard Land at the State Farm, Westbrook.

Showing Breaking and Subsoil Ploughs at work.



SUB-SOIL PLOUGH—WESTBROOK EXPERIMENT FARM.

Rather lose a season, and either let the land lie fallow or take a crop of hay, corn, or pumpkins off it, than plant the trees in soil that is in a totally unfit condition to grow them, as trees stunted at first never do as well as those that grow right away without check, and it will be found that the loss of a season will be more than made good by the increased vigour and growth of the trees.

FENCING.

Fence the orchard well before planting a tree; put up a good fence—not a light cheap fence, as such fences are not suitable for orchards, and are always the dearest in the end. The orchard fence should always be proof against all farm stock; and when hares, rabbits, or marsupials are present, it should be proof against these animals as well, as any of them, especially hares and rabbits, do great damage in an orchard. Where timber is plentiful and good, posts and rails make the best fence, with netting on the outside if required. Whenever netting is to be used, one side of the posts should be hewn square, so that the netting will lie well against the posts, and can be easily fastened to them. Where timber is not so plentiful, then a good wire fence with strong posts 9 feet apart, and heavy straining-posts every 5 chains, makes an excellent fence. Where wire-netting is required, use the best, 3 feet 6 inches wide and of $1\frac{1}{2}$-inch mesh, for hares and rabbits; bury 6 inches of the netting in the ground, staple the netting firmly to the posts; and in the case of a wire fence, tie the top of the netting to a wire in the fence placed at the same height. Always put the wire-netting on the outside of the fence, as if placed on the inside there is a possibility of rabbits getting over. Netting in the orchard is the only certain precaution against hares and rabbits, and, though expensive, it will soon pay the cost of its erection, as an unprotected orchard is quickly destroyed by these pests. Use good paled gates, the palings close enough together to prevent any vermin from getting in, and hang the gates on good, heavy posts, that should in no case be used as straining-posts, but as gate-posts only. Place a good hardwood sill between the posts, and hang the gates so that there is no room for vermin to crawl between the bottom of the palings and the sills. If this is done and the gates are kept closed, you will have a fence that is proof against all vermin. Cheap gates hung on poor posts or on straining-posts are useless for orchards, as they are always getting out of order; whereas a good gate, well hung on good posts, will last for many years.

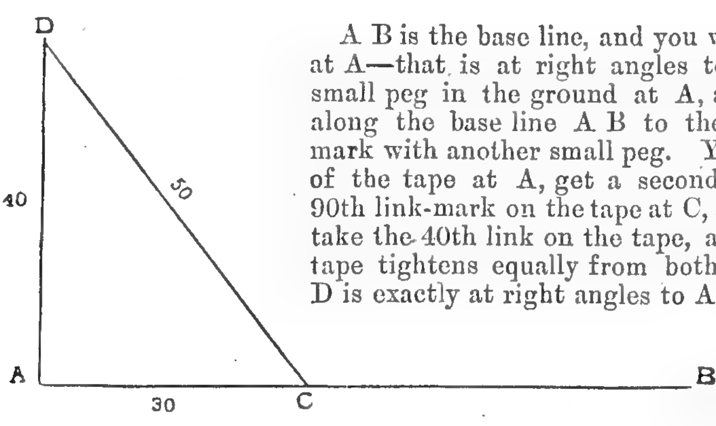
LAYING OUT THE ORCHARD.

When an orchard is once planted it is likely to stand many years; therefore it pays to devote extra care to laying it out accurately, as there are few prettier sights than a well laid-out orchard, and no greater eyesore to every intelligent fruit-grower than an orchard which appears to have had the trees broadcasted rather than systematically arranged. In planting an orchard the land should be so laid out that the trees are in rows every way, no matter what angle they are looked at—in fact, the best test of accurate planting is to have the trees on the long stems correctly in line. Correct planting, besides adding considerably to the attractive appearance of an orchard, is also of the greatest assistance in working the land, as the work can be done much more easily and expeditiously than when the trees are unevenly planted, and one has to dodge round trees with horses when cultivating in order to prevent the plough or cultivator from running into them. There are several systems or methods of arranging the trees by which the land may be laid off with the greatest accuracy, and it is simply a matter of opinion as to which system is the best. The following are the ordinary methods of planting, namely:—Planting in Squares; Hexagons, sometimes called septciple or equilateral triangle method (and erroneously called quincunx); Quincunx; Alternating Squares.

Planting in Squares.—Personally, I prefer planting in squares to any other method, as it is the simplest and best for cultivation; and though more trees can be planted on the same area of land if set out in hexagons, this is, in

my opinion, a very doubtful advantage, as the great fault of most growers is to plant far too close together as it is. To plant in squares, lay the land off in straight lines parallel with each other, and at an equal distance apart, and cross these lines with other lines at right angles to them, the cross lines being also parallel to each other and of an equal distance apart to the lines first laid off; the point where the lines cross is the place to plant the tree. In laying out an orchard, the first thing is to provide yourself with a planting wire, which may be of any desired length up to 500 feet, as that is about the greatest length that one can work satisfactorily. It is made as follows:—

Take a length of No. 10 or No. 12 white wire—a soft tough wire is best—and fasten a ring of ½-inch round iron, 4 inches inside diameter, to one end of it. Place this ring over an iron bar or stake firmly fixed into the ground, and run out a few feet more wire than is required. Fasten the loose end of the wire securely to a fencing-bar, fix the bar firmly in the ground, and strain tight. Now measure the strained wire carefully, starting from the end with the ring on, and place marks on the wire at the distance apart you wish to plant your trees or vines, taking care that the distance from the outside of the ring to the first mark is exactly the same as that between any two marks on the line. When the desired number of marks has been put on, then bend on another ring similar to the first at the same distance from the last mark as the first ring is from the first mark, and the planting wire is completed. To make the marks on the planting wire, bend a piece of No. 20 copper wire round the white wire, and solder it in place. If required for planting trees and vines, the same wire may answer both purposes; marks, say an inch in length, being used for the trees, and shorter marks, say half-an-inch being used for the rows of vines that would come between the rows of trees; thus, say it is desirable to plant trees at 20 feet apart, and vines at 10 feet apart, then inch marks are placed at every 20 feet, and half-inch marks at every intermediate 10 feet. Marks made in this manner are easily seen—do not shift, and do not wear out. A planting wire made in this manner will last for years with ordinary care, and, if kept free from kinks, seldom breaks. Its use saves a great deal of time, and ensures accurate planting. When laying out the orchard, select the longest side as a base line and stretch your planting line along it, putting in stakes at each mark on the wire. At each end of your base line run a line exactly at right angles to the base line and the whole width of the land to be planted, staking these side lines in the same manner as the base line. In planting large orchards, a theodolite is very handy for laying off the right angles correctly; but for small orchards you can get your right angles practically correct, if you use extreme care, by the same means that a bricklayer uses to set his walls out straight and square. The length of the sides of a right-angle triangle are always in the ratio of three, four, and five; therefore, if you want to lay off a line at right angles to any point on a base line, you can do so by means of an ordinary tape measure, as shown in the following drawing:—



A B is the base line, and you wish to lay off a line at A—that is at right angles to A B. You place a small peg in the ground at A, and measure 30 links along the base line A B to the point C, which you mark with another small peg. You next hold one end of the tape at A, get a second person to hold the 90th link-mark on the tape at C, and let a third person take the 40th link on the tape, and walk back till the tape tightens equally from both ends, and this spot D is exactly at right angles to A on the base line A B.

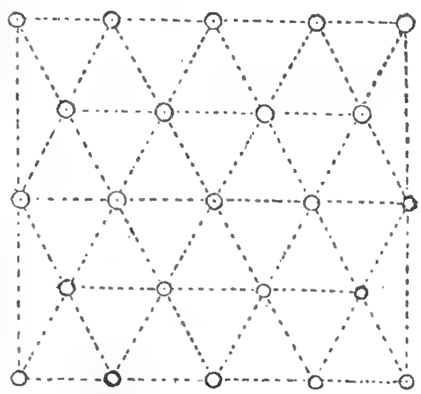
Having run and staked your base line and the two end lines at right angles to it,

you next complete the fourth side of your rectangle, making it (the rectangle) as wide as your planting wire is long. Stake the fourth side, and then stretch your planting wire from the second stake on your base line to the second stake on the fourth side. Stake and then shift to the third peg on each line, and so on till the other end is reached. If you have taken your right angles correctly, and kept the wire strained equally tight all through, you will now find that the rows of stakes are in line in every direction, and the land is ready for planting the trees.

If the stakes are to be permanent, as in the case of vines, then they should be substantial, say not less than 3 inches square, and of wood that is not readily destroyed by white ants, such as the hard wood of bloodwood, ironbark, or cypress pine; but where the stakes are used simply to mark off the land and are taken away when the tree is planted, then there is nothing better than plastering laths or thin pieces of stringybark or other suitable timber.

Planting in Hexagons.—The hexagonal or equilateral system places every tree at an equal distance from all others, and more completely fills the ground than any other method. It has also the advantage of presenting a greater surface to the wind than a square, the outer trees thus protecting the inner ones.

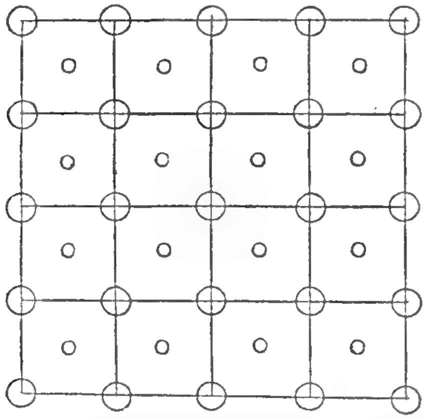
The following drawing shows the method of planting in hexagons, which is done as follows:—Lay off and stake the base line in the same manner as when setting out a square. Set off the two side lines at right angles also as described, but, instead of placing the stakes at the same distance apart as they are on the base line, the distance between the rows should be in the proportion of ·866 to the distance the stakes are apart on the base line; or, in other words, if the stakes are 20 feet apart on the base line, then the distance between the rows will be as nearly as possible 17 feet 4 inches. Instead of starting from the base line to the fourth side, as is done in the case of planting in squares, stake along the rows, taking care that the stakes on the 2nd, 4th, 6th, 8th, &c., rows come midway between the stakes on the 1st, 3rd, 5th, 7th, &c., rows, which is done by having a mark on one end of the planting line, midway between the ring and first mark; and if this mark is placed against the end stakes in the even numbered rows, it will bring all the marks on the line midway between those of the odd numbered rows, so that the stakes will appear as shown in the illustration.



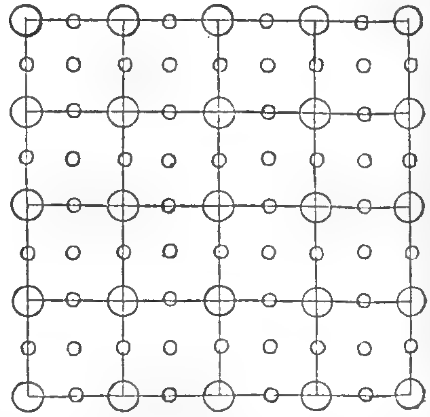
Do not plant your trees too close together, as, though you will get an earlier return from the orchard, the growth of the trees will be cramped as they grow older, and the quantity and quality of the fruit will deteriorate. With certain varieties of trees, such as walnuts, chestnuts, strong-growing figs, and mangoes in rich soils in the more tropical parts of the colony, it is desirable to plant the trees from 40 to 50 feet apart each way, and in this case quick-growing trees may be planted between the permanent trees till the latter require the whole of the land, when the quick-growing trees may be cut out. This is best managed by planting in one of the following manners:—

1st. *The Quincunx.*—Here we have a square of four trees, at right angles and equidistant from each other, with a tree planted exactly in the centre, just where two lines drawn diagonally from the opposite corners of the square would intersect.

When the tree becomes too crowded, the fifth or centre tree in each square is removed. [*See* drawing.]



The Quincunx.



Alternating Squares.

2nd. *Alternating Squares.*—Here we have the four permanent trees, forming the outer angles of four smaller squares; and when the ground becomes too crowded, all the trees, excepting those that are to remain, are removed. The manner in which this is done is easily seen by referring to the above drawing.

The following tables show approximately the distance apart at which to plant various kinds of fruits, and the number required to plant an acre. It is, however, impossible to say exactly what is the best distance for any individual fruit, as this depends very largely on the nature of the soil, temperature, and rainfall of the district in which it is planted; but in any case, if there is any doubt, it is better to be on the safe side and plant too far apart rather than plant too close:—

Variety.	Distance apart.	No. of Plants for Square Planting.	No. of Plants for Hexagonal Planting.
	Feet.		
Apples	25 to 30	69— 48	79— 55
Pears	20 to 25	109— 69	125— 79
Strong-growing cherries	20 to 25	109— 69	125— 79
Duke and Morello cherries	20	109	125
Plums and prunes	20	109	125
Peaches and nectarines...	20 to 22	109— 90	125—104
Apricots	25 to 30	69— 48	79— 55
Figs	20 to 40	109— 27	125— 31
Table grapes	8 to 10	680—435	785—502
Walnuts and chestnuts...	40 to 50	27— 17	31— 20
Oranges	20 to 30	109— 48	125— 55
Mandarins	18 to 22	134— 90	154—104
Sugar and Lady's Finger bananas	18 to 20	134—109	154—125
Persimmons	18 to 22	134— 90	154—104
Custard apples	18 to 25	134— 69	154— 79
Gooseberry and strawberry guavas	10 to 12	435—302	502—348
Gooseberries and currants	8	680	785
Rhubarb	4	2,722	3,130
Coffee	7 to 8	807—680	928—785
Rock-melons	4 to 6	2,722—1,210	3,130—1,397
Water-melons	8 to 10	680—435	785—502

The following are usually planted in rows, the distance of the plants apart in the rows being much less than the distance between the rows:—

Raspberries	3	feet in the row.	8	feet between the rows.
American blackberries	3 to 4	,, ,, ,,	8	,, ,, ,,
Pineapples	1 to 2	,, ,, ,,	8	,, ,, ,,
Strawberries	1 to $1\frac{1}{2}$	,, ,, ,,	3 to 4	,, ,, ,,
Wine grapes	6 to 8	,, ,, ,,	8 to 12	,, ,, ,,
American grapes	10 to 15	,, ,, ,,	10 to 12	,, ,, ,,

Pineapples are sometimes planted in double rows about 2 feet apart, with 8 to 10 feet between each double row; and strawberries in double rows $1\frac{1}{2}$ to 2 feet apart, with 4 feet between the double rows—this being a good method where the strawberries can be irrigated.

Co-operation in Marketing Fruit.

SUMMARISING an important paper on this subject read by Mr. A. Lorie, General Manager of the Teviot and Alexandra Fruitgrowing Company, (Limited) at the Conference of Australasian Fruitgrowers held at Wellington (N. Z.) in May, 1896, we notice more particularly the following points which should commend themselves to our Queensland fruitgrowers :—

Co-operation, Mr. Lorie said, was no new thing in New Zealand, but it was only when the Teviot men tackled the entire question that it was pulled through successfully. The slipshod system of disposing of orchard produce prior to the year 1890 was described and condemned. When the rapidly increasing output taxed the growers beyond the capability of their resources they requested the writer to propose a system by which a reliable market could be found. The task was one of great difficulty; the supply already exceeded the local demand even with the support of the jam factories. But as a set-off, it only required the splendid qualities of the Teviot fruit to be known to secure a wider market.

But the first attempt to organise and consolidate the Teviot fruitgrowers ended in failure, owing to vested interests. Those who had established a trade of their own hesitated to give up their connection, which had taken years to establish. So much was done, however, that four systems of disposing of the produce were tried during the next season. A portion was sold by the growers themselves, another portion was consigned to retailers, and the remainder was divided between Mr. Lorie and another salesman.

Naturally, fierce competition arose between rival salesmen and the locally established grower; but in the end it was decided by growers that Mr. Lorie's returns were the most satisfactory, and he was again asked to try and induce the Teviot men to unite and form a co-operative association. Then other difficulties arose, and reasons were given why one or the other should not sign an agreement. Finally, he made the growers a cash offer for the whole output of their district, the prices being those they had received last season less 10 per cent. commission. But one dissentient, who would not bind himself for ten years to sell to Mr. Lorie, was the fly in the ointment. The negotiations were broken off on that basis and a fresh start was made. The growers now agreed, under a penalty of £100, to send all their produce to him for sale, and thus the Teviot and Alexandra Fruitgrowing Association was formed in 1891-92.

Now arose difficulties with the factories, which refused to buy except direct from individuals. The retailers took the same stand. Eventually they were satisfied that they would receive fair play, and the association at the end of the season had to congratulate themselves on entire success. Prices had improved, and although 116½ tons of fruit were received, none was lost by decay.

The season 1893-94 opened with a very heavy yield, and growers became anxious as to the disposal of such large quantities of fruit. But all went well; every case was sold at good prices, when suddenly all was ruined by one grower consigning the remainder of his fruit to an outside firm. Prices collapsed, and the T. and A.F.A. became a thing of the past.

Once more Mr. Lorie undertook to organise the growers, this time on a footing which would admit of no treason. An agreement was drawn up by Sir Robert Stout, who instructed the growers that in order to get a legal status it would be necessary to register as a public company, which was accordingly done. None but fruitgrowers were eligible as shareholders, and even they were only

allowed to take up shares to the extent of 10 per cent. of their largest one year's crop of fruit. By this it was ensured that every grower contributed to the company an amount equivalent to his interest in the fruitgrowing industry. Further, no fruitgrower was allowed to hold shares unless he first signed an agreement to sell to the company (at a fixed price) the whole of his fruit consigned to any part of New Zealand north of Milton. The agreement with the growers provided for orchards being kept clean, for inspection of orchards, and for the grading of the fruit. It was also arranged that one of the growers should be continually in the company's stores, with access to all books and papers relating to the association. Every night, after the day's fruit was sold the manager conferred with the growers' representative as to the prices to be paid them for next day's sales. These prices were wired to the growers, and then if a loss was sustained it did not affect them, as they were absolutely guaranteed the prices quoted.

After the fruit was unpacked and properly graded, sales were daily held at 3 p.m. for the trade only, and at 5 p.m. for the public. The results were at once seen. Buyers must now go to the sellers instead of the seller running after the buyers. Competition amongst buyers resulted in fair prices. Nor was this the only good result of co-operation. Cases which were in the past always given to the buyer, had been charged for, this item alone amounting to a considerable sum annually. Claims against growers, formerly serious, were now unknown; freights had been materially reduced, and satisfactory arrangements made with outside markets, which, without co-operation, would have been impossible. Prompt returns were received from the association's agents, owing mainly to the almost perfect way in which the fruit was graded and packed. With respect to the manager of the association, the company had no power to dismiss him unless by the vote of 75 per cent. of the total subscribed shares. This ensured him, during good behaviour, a perfectly free hand, which was absolutely essential to success, since interference with the business arrangements of a business man by growers, would necessarily result in disaster. Under the company's *régime* growers knew that they were bound together for all time, and so made up their minds to pull together, the result being that the Teviot and Alexandra Fruitgrowing Company held the proud position of being the most independent body of fruitgrowers in the colony. With combination any body of growers can obtain the same position.

By the Articles of Association of the company it is enacted :—

1. That none but fruitgrowers approved by the directors are to hold shares in the company, except by resolution at special meeting.

2. If any person shall, by the operation of law, through death, lunacy, crime, or bankruptcy of a shareholder become entitled to any shares in the company, and such person shall not be a fruitgrower approved by the directors, then he shall not be entitled to hold the said shares for a longer period than six months, unless he cannot dispose of them to a fruitgrower approved by the directors at par or over par. Should he hold them longer than six months, and [not*] be able to dispose of them as aforesaid, then the said shares may be forfeited by the directors, and sold to any fruitgrower at the best price obtainable for them, and the proceeds of such sale shall, after the necessary expenses of forfeiture and sale have been deducted, be paid to the person who held the same shares before forfeiture.

5. No dividend of more than 10 per cent. on the paid-up capital shall be paid by the company.

The agreement between the company and individual growers reads as follows :—

An agreement, made this second day of June, one thousand eight hundred and ninety-four, between the several persons whose names are stated in the schedule hereto (hereinafter called "the fruitgrowers") of the one part, and the Teviot and Alexandra Fruitgrowers' Company (Limited) (hereinafter called "the company") of the other part, whereby the fruitgrowers agree mutually each with the other and others of them and the fruitgrowers jointly and severally, and the company also mutually agree, in manner following, that is to say :—

1. Each of the fruitgrowers shall, in respect of his own orchard, from time to time take such steps and carry out such regulations having for their object the cleansing of the orchards belonging to the shareholders of the said company from blight and all other orchard pests as the directors for the time being of the company shall from time to time direct or frame, provided such directions and regulations are made to apply generally to and are enforced against all fruitgrowers for the time being bound by this agreement.

* Ed. *Q. A. J.*

2. If any fruitgrower shall neglect to take such steps or carry out such regulations as aforesaid within such reasonable time as the directors shall by notice in writing to such fruitgrowers prescribe, it shall be lawful for the company to do and perform all such acts and things as such fruitgrowers shall have neglected to do or perform, and all expenses incurred by the company in or about any acts or things done or performed by it as aforesaid shall be paid to the company by such fruitgrowers on demand, with interest thereon at the rate of 8 per centum per annum, from the time or respective times of incurring such expenses until the actual payment thereof.

3. The fruitgrowers shall sell to the company, and the company shall purchase such of their fruit as they shall send to Dunedin, or to any other part of the colony of New Zealand north of Milton, at such prices as shall from week to week be fixed by the general manager of the company, and the fruitgrowers shall not sell any of such fruit to any other company or person, and any fruit which the fruitgrowers may send to any other part of the colony for sale shall be sold in such manner and subject to such conditions that the same shall not be afterwards sold or offered for sale in Dunedin, or in any other part of the colony north of Dunedin.

4. Each of the fruitgrowers who shall fail to observe or perform any of the stipulations herein contained, and on his part to be observed or performed, shall for each such default pay to the company as and for liquidated damages the sum of one hundred pounds.

5. The company shall annually appoint some fit and proper person to inspect the orchards belonging to the fruitgrowers.

In witness whereof the parties hereto have executed these presents the day and year first before written.

Grape-Fruit.

The *Journal of the Jamaica Agricultural Society* contains an address delivered by Mr. G. Morris, of the Royal Gardens, Kew. Mr. Morris accompanied the Royal Commission which lately visited the island to inquire into the state of the sugar industry.

From this address we extract a few remarks on orange culture in Jamaica:—

"Oranges have hardly yet been systematically cultivated here. Yet there are several millions existing over the island in a semi-naturalised condition. . . . Last year, owing to the falling off in supplies from Florida, there was a keen demand for Jamaica oranges in the United States. Jamaica was fully able to meet this sudden demand, and it shipped oranges to the large value of £169,293."

Speaking of the "grape-fruit," Mr. Morris said:—

"Amongst citrus fruits, there is no fruit which appears to be in greater demand, and obtains such high prices as the grape-fruit. This is a variety of the shaddock or pomelow. It is so called because it grows in clusters as in a bunch of grapes. On account of its tonic properties, it has lately come into great request in the American market. The most esteemed sort is of good size, with a pale-yellow, polished rind. Grape-fruit should be allowed to get thoroughly full on the tree. Immature fruits are of an inferior flavour. The tree, when budded, is a vigorous grower and very prolific. It is recommended to bud on either the sour orange or rough lemon stock. Provided the fruit is full-juiced and of a delicate flavour, the larger sizes are more in favour than the smaller ones."

Queensland orange-growers should take note of this, and at once commence experiments with the fruit. If the demand should prove as great in England, there will be a splendid market open to our fruit-growers. The Jamaica orchardists are already taking steps to exploit the British market with this fruit.

Wellington Point Agricultural, Horticultural, and Industrial Association.

RESULTS OF FARM AND ORCHARD COMPETITION.

Mr. J. Davidson, of Torres Vedras, Wellington Point, President of the above Association, supplies the following information regarding the awards of the judge, Mr. S. C. Matthews, of New Farm, in connection with the competition for farms and orchards during the late show on 3rd July. Judging by the care exhibited in making the awards, which we understand have met with general approval, Mr. Matthews must have had no light task, and is deserving of the warmest praise for his disinterested and wise decisions. Mr. Davidson states that it is intended next year to award prizes for farmsteads including cultivation, fencing, buildings, and general good management, in addition to those intended to be given for gardens and orchards. A special prize has already been offered for the best orchard.

The Wellington Point Association could not have seized on a happier idea than that detailed above. It cannot fail to have the best results, by creating an emulation amongst farmers and orchardists, which must lead to improved methods of cultivation, to proper care of implements and farm buildings, and, above all, to leading the farmers to study the most approved and scientific methods of production.

The results of the competition are as follow:—

RESULTS OF FARM AND ORCHARD COMPETITION, WELLINGTON POINT AGRICULTURAL SOCIETY'S SHOW, 3RD JULY, 1897.

Competitor.	Address.	Health. Freedom from Disease. 30	Cultivation. Utility. Cleanliness. 20	Crop. State of Productiveness. 20	Variety. Quality. Quantity. 15	Symmetry. Form. Pruning. 15	Total. 100	Remarks.
James Moore	Redland Bay ...	21	15	16	12	13	77	An excellent farm; obtains a high average throughout.
D. J. Collins	,, ,, ...	18	15	17	13	13	76	Another excellent farm, only outdistanced by No. 1 in health column.
John Doig	,, ,, ...	23	20	13	8	10	74	Taking into consideration the number of trees and size of this farm, for cleanliness and cultivation it cannot be beaten, while in health column he ranks second.
Henry Day, senr. ...	,, ,, ...	16	15	15	14	12	72	Yields the highest points for variety, owing to the enterprise of the owner in cultivating the Cayenne chili.
E. Hinemann	,, ,, ...	27	20	13	5	7	72	Yields the highest points in health and tillage—its drawback being that it is confined to bananas of two sorts.
J. and J. Holtzappel...	Mount Cotton ...	14	14	15	10	7	60	The labour and industry expended on this farm would, under better natural advantages, have produced a far different result in the competition.
James Cross	Cleveland ...	15	14	14	7	10	60	Soil inferior compared with the other competitors.
Gilbert Burnett ...	Wellington Point	15	20	10	7	8	60	The cleanest in cultivation of those competing. We can confidently recommend Mr. Burnett's mulching to farmers of district.
Fredk. Muller ...	Redland Bay ...	15	12	12	10	10	59	Labours under disadvantage of exposure to S.E. gales.
Michael Lindsay ...	Cleveland ...	16	15	8	7	13	59	Farm too young to compete successfully against the others, but a great credit to the proprietor.

Entomology.

SCALE INSECTS—COCCIDÆ.

By HENRY TRYON,

Entomologist.

Of insects that are prejudicial to the successful enterprise of the cultivator of the soil, none possibly merit such claim on his consideration as do the members of the family Coccidæ, a family that includes not only Scale Insects proper—or so-called "Scale," but also "Coccus"—or "Mealy Bug," as well as other forms of this class of animal life; for all plants are liable to their attacks, and the injuries that they occasion are formidable ones; and, moreover, a knowledge of their appearance and vital characteristics whilst contributing to their early recognition serves at the same time as a powerful auxiliary in contending with their injurious presence.

Although present probably throughout the entire temperate and tropical regions of the earth, it is in the latter especially that these insects obtain not only their greatest specific variation, but also their highest individual numerical development. W. M. Maskell, a great authority on Coccidæ, reported in 1894 the occurrence of no less than 298 distinct species and varieties (the larger proportion of which have been made known to science by himself) of these insects as occurring in Australasia and the Pacific Islands, and since then has added upwards of twenty to this number.* From the same source also it will be learned that a large proportion of these have, as far as has yet been ascertained, an exclusively Australian habitat—a remark that applies also to many of the different genera to which the endemic species are assigned.

It is beyond the scope of this article to allude to, much less to describe, the different forms typical of the sub-families and sections into which this important family of insects is divisible. For information relating to this phase of the subject the reader is referred to various special memoirs dealing with the Coccidæ, but especially to Dr. V. Signoret's comprehensive "Essai sur les Cochenilles"†; W. M. Maskell's various able papers contained in the Transactions of the New Zealand Institute, that have appeared therein almost continuously, year by year, since 1878; and to E. E. Green's superb monography on "The Coccidæ of Ceylon," now in course of publication. It is proposed, in fact, to limit these introductory remarks to an attempt at affording an insight into the more interesting features that pertain to the particular kinds of scale insects that in Queensland at least are most noticeable for their destructive work.

The ordinary observer will have no difficulty in concluding that the Mealy Bug—*Dactylopius* (a species of which genus is at present very prevalent in the inflorescence of the Erythrina, or Coral-tree, of our Brisbane gardens)—is an insect, for he will readily detect its six legs, and the action of these as it pursues its crawling movement; but it will not be equally obvious to him that the same may be predicated concerning the circular, white or red, scale-like bodies that may encrust the wood of his rose-plants or the pale speck-like bodies that occur thickly sprinkled over the dark-coloured bark of his citraceous trees. And yet it is true also that these belong to the same class as

* W. M. Maskell:—"Synoptical list of Coccidæ reported from Australasia and the Pacific Islands up to December, 1894." *Trans. N. Z. Inst.*, 1894, *xxvii., pp.* 1-35. Wellington, 1895.

† *Annales de la Soc. Entom. de France*, Paris, 1868-1876. (Eighteen papers.)

the former, and are also like it endowed with similar vital characteristics. The same applies to the narrow mussel-shaped—brown or reddish-brown—bodies that are so frequently met with upon the branches, foliage, or fruit of his orange-trees, or upon the leaves of some favourite ornamental shrub, as, for example, *Murraya exotica*. Again the raised or depressed brown or black objects occurring so conspicuously upon the leaves and young wood of the fig, mulberry, as well as upon those of many other plants, are also living insects. So, too, are the little masses of pinkish red or white wax-like matter that may be met with now almost everywhere about Brisbane in these and similar situations. He will, moreover, experience the same misgivings should he isolate any such objects, and even be in a position to increase his powers of ordinary vision by the use of a magnifying glass. On Plates I. and II., that accompany this article, the Scale Insects, amongst others, to which allusion is above made, are portrayed as they appear under these circumstances, and yet it may be affirmed that they do not coincide with any general idea of insect-life that is entertained by ordinary observers. This remarkable difference that apparently obtains between Mealy Bugs and their allies and the other scale insects referred to is accounted for by the fact that the female insect—the form most commonly if not exclusively met with—in the former case, does not proceed in its transformations beyond a larviform condition (exemplified in other insects by the caterpillar or grub phase of existence), whereas in the latter it early passes into a pupiform state, or—as with the Lecanidæ or Soft Scales—into a condition closely approaching it, as pointed out by Dr. Antonio Berlese.

If by aid of the point of a needle an individual "scale" be raised from the surface to which it is attached, it will usually happen that a diminutive heap of red, yellow, or white dust-like material is brought into view; and should this be allowed to fall or be brushed on to any smooth white surface, it will be seen that the individual particles are apparently similar one to the other. In the case of the white scale of the rose (*Diaspis rosæ*), illustrated on Plate I., Fig. 3, in which the substance presents a pronounced pinkish-red colour, these particles may number upwards of 160, and yet this not constitute the entire sum of the progeny of the individual. Two of such objects as they appear when highly magnified are represented by Fig. 1 of Plate III., and a glance at these will suggest the fact that they are eggs. These scale-insect eggs are invariably oblong-oval bodies, and are of such size that in the case of the so-called Armoured Scale Insects—of which the Rose Scale is an example—from 116 to 128 placed end to end would form a line but an inch in length. The eggs of many other Coccidæ are larger; thus not more than 73 of those of the Orange Mealy Bug (*Dactylopius citri*) could be placed within the same unit of linear measurement; and, again, in the case of the Cottony Cushion Scale (*Icerya Purchasi*), Plate II., Fig. 7, this number would be reduced to 37.

It must not be inferred from what is stated, however, that all Scale Insects are oviparous or egg-layers, although the majority may be so described. In the case of certain species the progeny when born have the form of already active larvæ. This is the case with the Soft Scale (*Lecanium hesperidum*) figured on Plate II., Fig. 2, and with the Pernicious or San José Scale (*Aspidiotus perniciosus*, Comst.), about which so much has recently been written.

With egg-producing species—such as the Rose Scale mentioned—a portion, and with viviparous species the whole, of the coloured dust-like substance alluded to will be probably found on observation to exhibit marked activity, individual particles travelling over the white surface whereon they occur. Each of these moving particles is a young scale insect, and may be compared to a miniature Mealy Bug. They are, however, still very diminutive; thus when in this condition it will take from 100 to 110 young of the so-called Armoured Scales (*e.g.*, the Rose Diaspis, Red Scale, &c.) extended in single file, but touching one another, to reach an inch; for the young of the Orange Mussel Scale (*Mytilaspis fulva*, T. Toz.), 73; for the young of the Soft Scales (Lecanidæ), the latter represented by Figs. 1, 2, 3, and 4 on Plate II., from 50 to 60 will be

required; whilst for the Cottony Cushion Scale (Plate II., Fig. 7), in which the dimensions of the larvæ are exceptionally large, 24 may be contained in this measurement. This free life manifested by the scale insect at a period of its existence when it is still very small is the explanation of its apparent spontaneous occurrence or increase upon plants whereon its presence had previously escaped observation. Persistent activity throughout life is not, on the other hand, a character exclusively possessed by Mealy Bugs; for up to the period of life when the adult female insect is distended with either eggs or young, the Soft Scales (or Lecanidæ) manifest a certain degree of locomotion upon their food plants; and in the case of the Cottony Cushion Scale, a similar movement is displayed till even later in life. This feature is exhibited also by other members of the family.

One of these larval or young scale insects is represented by Fig. 2, Plate III., that relates to this condition in the Circular Purple Scale Insect (*Aspidiotus ficus*) itself shown on Plate I., Fig. 1.

From an examination of this it will appear that the insect at this period of its life is marked by distinct lines of division separating the nine different abdominal segments of which it is composed, and, moreover, well equipped with organs for locomotion, subsistence, &c. It has three pair of well-developed four-jointed claw-bearing legs, two antennæ or feelers, two eyes, and a long hair-like organ issuing from between the fore legs and folded upon itself—the characteristic proboscis of these insects. There are also two small apertures on each side of the body, one being adjacent to the origin of each of the first and second legs respectively. These are the breathing pores or spiracles. From the hinder border of the body project two long bristle-like organs. The legs, as shown in Fig. 3, Plate III., each terminate in four short tubular terminally inflated bristles. These are the so-called tenent hairs, and are of considerable assistance in securing adhesion to any body upon which the insect may happen to occur or which it may encounter. During this active stage—that continues, though no food seems to be partaken of, for three or four days, or lasts only as many hours—the young Coccidæ may crawl several feet from their place of origin, not only upon the tree itself whereon they come into existence, but also over the soil, and from this to any plant that may be growing therein. Thus also when several plants are packed together they may migrate from a single one to all those with which this is associated. They may also be borne short distances by the wind, or by moving water upon the surface of which they float. They again may become attached to a person's garments, and so be taken from one orchard to another; and the same may be accomplished by the bodies of other insects, as well as by the limbs of those and of birds also. The following allusion to the latter means of transference in the case of the Pernicious Scale may be cited in this connection:—

The active young lice (write Messrs. L. O. Howard and C. L. Marlatt) soon crawl upon any small winged-insect, particularly if the latter be of a dark colour, and may thus be carried considerable distances. They are frequently found crawling upon ants, which are great travellers. It is extremely probable that they also crawl upon the feet of birds, and may be transported by these carriers for many miles.

Some interesting observations have been made by Mr. Schwarz upon the transporting of these scale-larvæ by other insects. A little black lady-bird, *Pentilia misella*, which was very active in devouring scale-larvæ, was unfortunately equally efficient in transporting many of these young lice to other parts of the tree or to other trees; in fact, it was difficult to find a single beetle which did not carry on its back at least one larva of the San José Scale, and sometimes three or four were found upon a single wing-cover of a beetle. The small black ant, *Monomorium minutum*, was particularly abundant upon pears, attracted by the juices emerging from cracks; and almost every-one of these insects carried on its back one or more specimens of the young scale insects. Specimens of the little chrysomelid beetle, *Typophorus canellus*, were also found upon the trees. Both red and black specimens of this beetle occurred, and the interesting observation was made that while *Aspidiotus* larvæ crawled freely on the black individuals no specimens were to be found upon the red ones. The same peculiarity was found to hold true with the ants. The red ant, *Formica schaufussi*, was abundant upon the pears, but no specimens were found bearing *Aspidiotus* larvæ, while, as just stated, the little black *Monomorium* was always found carrying them.

As illustrating this transportation of the scale by birds or insects, the experience at Riverside Md., *ante* page 25, may be cited; and Professor Smith reports a similar instance in New Jersey, in letter of 13th January, 1896.*

* The San José Scale. *Bull. 3, New Series, Div. of Entom. U.S. Depart. of Agr.*, pp. 49-50. Washington, 1896.

With some members of the family Coccidæ the appearance as well as the active habits presented by the recently born young, to a greater or less extent, persist throughout the subsequent life of the insects into which they develop. This, as already stated, is so in the case of the Mealy Bug (*Dactylopius*) portrayed in Fig. 8 of Plate II. To a less extent the same condition obtains in the Soft Scales (Lecanidæ), representations of which are afforded by Figs. 1, 2, 3, and 4 on the same plate. In the adult female of insects belonging to this last-named sub-family, although recognisable, first nymph and second nymph stages intervene between the larval condition of life and that which corresponds to maturity, fixation does not take place until the latter has been attained; and although then different in appearance, outwardly, from the Lecanium individual when this is young, this difference merely arises from a continuous activity of those special glands that secrete horny or chitinous material, and that occur over the entire extent of the upper surface of the body, followed by a marked general depression (whence originates the typical scale-like form), accompanied by an expansion of the horny covering of the back of the insect that takes place not only at the sides but also in front and behind. Antennæ—or feelers—and legs, however, still persist, though these are completely hidden by the expanded portion alluded to, and can only be discerned on up-turning the insect. The same remark applies to the body-segments. The further changes that attend the pregnant condition are, however, more conspicuous, though not more profound. The body now appears, when viewed from above, much more elevated than before, and is augmented in volume. Meanwhile, as seen from beneath, the segmented hind-body shrinks up until ultimately it dries, but, notwithstanding, the legs and antennæ are recognisable, even so after the eggs or young have been brought forth and deposited beneath the scale that now adheres immovably to the surface of the particular plant affected by the special kind of Lecanium that it represents.

In the case of the Armoured Scale Insects, or Diaspinæ—a sub-family that is exemplified by the Red Scale, *Aspidiotus aurantii;* the Circular Purple Scale, *Aspidiotus ficus;* the Orange Mussel Scale, *Mytilaspis fulva*, Targ. Toz.; Glover's Mussel Scale, *Mytilaspis Gloveri;* the Apple Mussel Scale, *Mytilaspis pomorum;* the Orange White Scale, *Chionaspis citri;* the Rose Diaspis, *D. rosæ;* the Peach Diaspis, *D. amygdali*, Tryon; and the Parlatoria Scale, all of which insects are figured on Plate I.—we have Coccidæ that are all distinguishable when adult by the presence in connection with them of a protecting shield-like cover (that is capable of being lifted by means of a fine needle-point or similar appliance), and by the fact that they exhibit a naked fleshy, white, yellow, orange, pink, or red coloured body, that is brought to light when this shield is raised.* These scale insects manifest also noteworthy differences in their mode of development from the Soft Scales, or Lecanidæ, last considered.

The duration of the active life of members of this sub-family, as already stated, is limited to the few hours or days immediately succeeding their birth, for the larvæ soon settle down and henceforth remain quite stationary upon their food-plant. Simultaneously with such event, the insect inserts its hair-like proboscis (Plate III., Fig. 2*b*) into the tissue of this, and so imbibes its juices, or commences to subsist at its expense. It next casts its skin, though it still continues to live beneath the protecting covering that this affords; but it soon, however, exceeds in size the dimensions of the latter, extending its body beyond it behind; although even previous to this, as noted by L. O. Howard and C. A. Marlatt in the case of the San José Scale (*op. cit.* p. 40), and by the writer in the

* The under surface of the body is likewise protected by a scaly plate, but this as a rule is of extreme tenuity, appearing merely as a delicate film at the place of attachment when any particular scale insect belonging to this sub-family is raised. In the Red Scale of the orange, as shown on Plate I., Fig. 2A; however, this so-called ventral scale is attached to the upper or dorsal one; and so the insect's body partly enclosed between the two not only enjoys additional protection, but is almost hidden from view when the insect is looked at from beneath. The Mussel Scales—*Mytilaspis spp.*—also again exhibit a ventral scale. (*Vide* Plate I., Figs. 6A, 7A, 8A, and 9A.)

case of White Scale of the Peach (*Diaspis amygdali*, Tryon),* it may secrete tortuous threads from its body-surface and these by interlacing give rise to a more or less dense covering. Meanwhile also, in anticipation of its growth, it has commenced to form—also by secretion—a supplementary shield by pouring out a waxy substance from certain peculiar glands that occur just within the hind border of its body (and elsewhere in the case of some kinds of Diaspinæ—*e.g*, Parlatoria), and whose nature and function have both been so ably elucidated by A. Berlese.† This material soon becomes matted together, and, as the resulting supplementary shield that thus arises increases; it forms the protecting body alluded to. On Plate III. these features, in a scale insect that occurs upon the sugar-cane, and is named *Chionaspis sacchari-folii*, as described by Dr. L. Zehntner,‡ are illustrated: Fig. 4 representing the stationary larva; Fig. 5, the skin of this—(*a*) partly protecting the pupiform nymph, (*b*) that arises in succession to this after its first molt. This has already formed by secretion a semi-transparent scale (*c*), that not only covers but also extends beyond it. The nymph, having accomplished this work, again casts its skin, that becomes in turn added to the protecting covering, and continues to still increase the extent of the scale proper by secretion as before. (This is shown in Fig. 6 (Plate III.), that offers a representation of—(*a*) the first skin, (*b*) the second skin cast, and (*c*) the secreted portion of the scale.) This increase is made either all around it, as in the Circular Scales (Plate I., Figs. 1 and 2); or in one direction, as in the Mussel Scales (Plate I., Figs. 6, 7, and 8).

Thus the young scale insect undergoes two molts, and has attained a form and structure that, in the case of the female, is not to any extent departed from until it becomes distended with, or gives rise to, an egg or larva progeny. Unlike, however, what has been stated to occur in the Soft Scales, or Lecanidæ, not only is the power of locomotion lost with the first molt but the members on which this depends; and, with its legs, it loses also its antennæ or feelers. It now lies inert, and presents an appearance similar to that shown in Fig. 7, Plate III., that portrays a magnified image of the insect seen lying naked beneath the scale proper when this is raised as above described. Size, shape, and general outline, however, vary with the particular Armoured Scale under observation, even more so than do these attributes in the protecting scales (*vide* Plate I.). One insect may be kidney-shaped, another top-shaped, another circular, another elongate, &c. The same remark also applies to colour—white, pale-yellow, orange, red, and purple being exhibited by different insects. The features that appear most conspicuous in it are now its mouth-organs: a fact in accordance with the experience of what now constitutes its predominant habit—that of feeding.

This peculiar mouth-organ (illustrated on Plate III., Fig. 9) consists of a frame-like apparatus with inner (9*b*) and outer (ventral) buckler-like plates connected together anteriorly with strap-like bodies. The outer of these plates (9*a*) is named, and answers to, the clypeus in other insects. Beyond the front border of the latter in the majority of scale insects are one, and in others—*e.g.*, Mealy Bug, *Dactylopius*—two, much smaller plates (9*c*). These are jointed to it so as to be freely moveable. They form what A. Berlese names the "succhiatoio," or sucker-organ, and the mentum of other authors. This small plate, or the terminal one when more than one is present, is pierced, near its extremity, by a small hole. Through this pass two hair-like bodies or setæ (9*e*), each of which arises, from beneath the ventral plate or clypeus, from two distinct roots (9*d*). These hair-like organs are elastic, may have a horny consistency, and correspond to the maxillæ (smaller jaws) and mandibles (jaws proper) of other insects. They are usually very long, even often exceeding in length the body itself, a considerable portion, when the whole is not extended, being held in reserve in the form of a loop between the orifice in

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* Insect and Fungus Pests, p. 91. Brisb. 1889.

† "Le cocciniglie italiane viventi sugli agrumi—Ghiandole sericipare."—*Rivista di Patologia Vegetale*, vol. iv., pp. 212-246. Firenze, 1896.

‡ "De planten luizen van het Suikerriet op Java," pp. 10-11.—*Mededeelingen van Het Proefstation Oost-Java, Nieuwe Serie, No.* 36. Soerabaia, 1897.

the "succhiatoio" and the clypeus (*vid.* Plate III., Fig. 2*b*). This proboscis is, as above remarked, held deeply fixed in the tissue of the plant upon which the Scale Insect occurs, and remains so during its entire stationary existence, its component hair-like organs together forming a tube through which the plant-sap is imbibed. This apparatus* that subserves the purpose of feeding, and which is constructed on one plan in almost all Coccidæ, has been described with some detail, since—as is obvious—it constitutes the means by which the scale insect establishes the injurious relationship to the plants that is often of such momentous significance to those whose interests are connected with their successful growth.

Protected by its scale-covering, formed, as has been seen, partly of its discarded skins, but principally of a specially secreted portion, the insect increases in size, and the latter *pari passu* with it. This scale itself presents differences of form or colour, according to the particular species of insect to which it belongs, being round, ovate, mussel-shaped, or elongate and parallel-sided. It may be depressed, or more or less elevated. Upon or in connection with it, occur the cast-off skins of the larva and nymph respectively, which often form a boss-like body, and may be either central, excentric, or even terminal. Plate I., devoted to several different kinds of Armoured Scale Insects, illustrates this statement. Already prior to its having obtained its full dimensions the union of the sexes may have taken place, and the body now becomes distended with eggs (as shown in Fig. 7, Plate III.) or with larvæ, the latter each simply enclosed in a skin-like amniotic covering. It must, however, be borne in mind that in the case of the Diaspinæ (Armoured Scales) and Lecanidæ (Soft Scales), as in other sub-families of Coccidæ, the intervention of the male sex is by no means essential to the development and production of progeny, either in the oviparous or viviparous kinds.† In fact, with some species it must be a most exceptional act, since the males are so extremely rare as to have been never met with. Dr. A. Berlese, who has paid special attention to the Scale Insects affecting the orange, writes regarding two of them—the Soft Scales, *Lecanium hesperidum* and *L. oleæ*, figured on Plate II. (Figs. 2 and 4)—that he has never been fortunate enough to obtain adult males of either,‡ and his experience is that of nearly every other investigator.

The act of parturition has been shown in the case of the San José or Pernicious Scale—*Aspidiotus perniciosus*—to extend on an average throughout a period of six weeks, and it has been estimated that from nine to ten young are born every twenty-four hours. At first—it is stated—the young are born with less frequency than subsequently happens, and that there is a corresponding reduction in reproductive activity towards the end of the life of the individual. In this insect, also, birth ensues by day or by night, perhaps more so during the day than during the night.§ From this it may be inferred that, prior to their extrusion, the development of the eggs, or of the young of the Scale Insect, is a gradual process.‖ This gradual production of the young by the female, as remarked by the authors above referred to, has an important bearing on the question of remedies that aim at the destruction of the young as soon as they emerge from the female, since, in order to make them effective it becomes, consequent on this state of things, necessary to repeat them many times during a period of several (six in the case of *Aspidiotus perniciosus*) weeks.

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* The writer's information concerning this has been derived from A. Berlese, the learned Professor of the High School of Agriculture of Portici, whose patient investigations into the anatomy and morphology of certain Scale Insects, recorded in the different volumes of the *Rivista di Patologia Vegetale*, cannot be too highly extolled.

† The mode of union itself has been carefully described by Professor C. Sasaki in Bulletin, vol. ii., No. 3, College of Agr., Tōkyō, Kombaba, 1896.

‡ *Rivista di Patologia Vegetale*, vol. iii., p. 70, 1894.

§ L. O. Howard, and C. L. Marlatt: The San José Scale. *Bull. No.* 3, *New Series, Divis. of Entom. U. S. Dep. of Agri.*, pg. 45. Washington, 1896.

‖ This would appear also to be the interpretation of the observations of Professor C. Sasaki regarding the metamorphosis of *Diaspis patelliformis* (? *D. amygdali*, H. Tryon), recorded in his comprehensive article "On the Scale Insect of Mulberry Trees—*Diaspis patelliformis*, n.sp." Bulletin, vol. ii., No. 3, pp. 112-113, Imperial University, College of Agriculture, Tōkyō, Kombaba, 1894.

The deposition of eggs, or the production of living young in the Armoured as in other Scale Insects, is attended by and results in a great shrinkage of the hinder portion of the body, and the latter never afterwards expands again. Reference to Figs. 7 and 8 on Plate III. illustrates this phenomenon in the case of the Purple Round Scale—*Aspidiotus ficus.* The insect does not, however, immediately die, but on the other hand may yet remain alive several days, the procedure of dying being associated with a gradual drying up of its entire body. These eggs may remain when once born for a considerable time beneath the scale of their parent, and, in fact—as has been concluded from local observations—may pass the entire winter months in this position. At other times they hatch within a few days, during which time they darken in colour, as the embryo that they contain progresses in development. It must be also borne in mind that the protecting scale may remain for a long time attached to the plant after the animal that it has protected is dead, and especially is this the case with closely adhering kinds—*e.g.*, Wax Scales (*Ceroplastes*)—and gall-forming species.

From the foregoing observations relating to the Soft Scales (Lecanidæ) and the Armoured Scales (Diaspinæ) it will be concluded that what is the outward presentment of the insect consists of a peculiar shield that is either composed of the body-wall strengthened by special horny matter produced by dermal glands, or is a separable object formed in part of exuviæ (molted skins), but mainly of an inorganised secreted substance, and that this has for its function the protection of the delicate body of the insect proper (that may often itself escape observation) and of the eggs or young that it may produce.

This is also the case with the scale insects included in other sub-families, as well as with kinds other than those alluded to, but comprised in the same group with them. In the Mealy Bug—*Dactylopius* (Plate II., Fig. 8)—the secreted material that protects the body takes the form of white farinose (mealy) matter that occurs as distinct particles, and outwardly projecting processes of similarly constituted waxy substance. The eggs, on the other hand, are for the most part held immediately beneath the body of the insect from which they issue in a mass of white wool-like fibre, also of wax. The Pulvinaria Scale (Plate II., Fig. 6) has the hard covering of the *Lecanium*, but this in it merely serves to protect the body, the eggs being placed in an elongated white sac-like appendage that extends behind it for a distance many times exceeding its length. The Cottony Cushion Scale—*Icerya Purchasi*, Maskell—has again, like Pulvinaria, a separate similarly constituted ovisac, but this, like the parent insect itself, is very different in shape, and regularly fluted above (*vide* Plate III., Fig. 7). In the Wax Scale—represented by *Ceroplastes ruber*, Mask. (Plate II., Fig. 5), we have the body and the eggs also—as in the Soft Scales (*Lecanium*, spp.)—protected by a special covering. This now occurs as a thick deposit composed of wax, densely compacted together, that is closely applied to the surface of the plant upon which the insects rests—so dense and so closely applied indeed that respiration would doubtless be impossible were it not for the existence of open slits that exist in it at the site of the four spiracles—two on each side of the body—as shown in the figure referred to (Fig. 5*a*). In *Carteria* the covering for both body and eggs is composed of lac—or wax and resin combined. Finally, many Scale Insects live under the protection of and within woody galls of various strange shapes, whose origin on the plants they affect they themselves determine. This occurs in the Australian Brachyscelinæ.

Hitherto in this article reference has been made exclusively to the female insects and its transformations; but with the Scale Insects, as may be inferred from the foregoing statement regarding the rarity with which the opposite sex occurs, and the possibility indeed of the ensuement of the act of reproduction independently of its existence, the male insect need not always necessarily claim such consideration on the part of the agriculturist or horticulturist as must inevitably the former sex. In some species of Scale Insects the male sex is, however, well represented. This is especially so with many of the

Diaspinæ, or Armoured Scales—*e.g.*, the Rose Scale, *Diaspis rosæ;* and the White Scale of the Orange, *Chionaspis citri;* indeed, in the latter it is the male that is the more conspicuous of the two, and has suggested the popular designation assigned to the insect.

During its first or larval stage of existence both male and female are alike in every Scale Insect. The tiny young issuing from the egg presents the same external characters, and is also indistinguishable by size. This casts its skin, and then goes through a nymph and pupa stage, a similar molting of the tegument marking the passage also from one to the other. The third or pupa stage is followed by one in which the insect assumes a winged form (such as is represented on Plate III., Fig. 10). In the Mealy Bug—*Dactylopius* (Plate II., Fig. 8)—the nymph resembles the larva in having legs and feelers, but the mouth organs become obsolete, the peculiar hair-like rostrum being already lost with the larval skin. In the second nymph or pupa stage certain pad-like organs are present along each side of the body. These contain the rudiments of the wings that are to appear after the next shedding of the skin. During these transformations the Mealy Bug takes little or no food; indeed, it is incapable of doing so, and remains in or near the cottony secretion surrounding the adult female whose progeny it represents. In the next or adult stage the insect is dipterous, or two-winged; it has comparatively well-developed legs as in the preceding ones, relatively large 10-jointed antennæ or feelers, two large eyes, but still no mouth-organs. This is the perfect male, which, though comparatively large in the case of the Mealy Bug, is still a diminutive insect, measuring (in *Dactylopius citri*) only three-tenths of an inch in length.

The Soft Scales, or Lecanidæ, agree with the Mealy Bugs in that in the nymph and pupa or two-nymph stages the legs and feelers are maintained, but, unlike that which occurs with these insects, they are throughout their duration protected by a hardened shield, resembling that of the female, but smaller, relatively longer, and having also a smoother surface. Moreover, immediately prior to the issue of the winged insect, this scale becomes pale-coloured and ultimately white. The winged form differs from that of the Mealy Bug insomuch as the hind-body does not terminate in a simple rounded prominence as in it, but is endowed with a long slender style that is ancillary to the sexual union, and arises from the fact that the female insect in Lecanium is otherwise inaccessible owing to the expanded border of its shield-like covering, and notwithstanding the presence in this of an anal cleft therein. But, as already remarked, male forms of *Lecanium* are but rarely encountered.

The Armoured Scales, or Diaspinæ, present us with insects of which the males, like the females, are during their intermediate or nymph and pupal stages endowed with well-developed protecting scales—partly formed of rejected skins, but principally of specially secreted matter. Their general form, as exhibited in several genera, is shown on Plate I., of which Fig. 2B represents the male of the Red Scale (*Aspidiotus aurantii*); Fig. 1A, that of the Purple Round Scale (*Aspidiotus ficus*); Fig. 3A, that of the Rose Diaspis (*Diaspis rosæ*); Fig. 4C, that of the Peach Diaspis (*D. amygdali*); Fig. 7B, that of the Orange Mytilaspis (*M. fulva*); and Fig. 9A, that of the White Orange Scale (*Chionaspis citri*). From an examination of these figures it will appear that the scale of the male is much smaller than is that of the female, also that it is narrower. Again, that whereas in some cases it repeats the female scale in miniature, in others it is structurally different. This is especially so with the two males of Diaspis (Figs. 3A and 4C) and with the White Orange Scale (*Chionaspis citri*) figured. In their case the secreted portion is quite white, and is provided in each of them with three low longitudinal keels. It is, as already remarked, the white male scale that is so conspicuous in the case of citraceous trees infested with *Chionaspis citri*—the female, greyish brown in colour, being, on the other hand, difficult of discernment when occurring upon the bark thereof. The animal itself, in both nymph and pupa stages, differs from the young of both the Lecanidæ and Mealy Bugs (Coccidæ) at these periods in their growth. As with

the female insect they have lost already both their legs and their antennæ or feelers, and with the passage of the nymph to the pupa the rostrum or feeding organ is also discarded. The perfect or winged insect has the terminal abdominal style noticed as existing in the species *Lecanium*, but in the armoured scale this is relatively longer and more slender. (*Vide* Plate III., Fig. 10A.) It is decidedly a minute animal, thus the length of the body, excluding the anal-style, in the San José Scale (*Aspidiotus perniciosus*) is but 6 mm. (*i.e.*, little more than 1-50th inch).—L. O. Howard and C. H. Marlatt; in the peach Diaspis (*D. amygdali*) it is 8 mm. (*i.e.*, about 3-100th inch), the wing expansion being 2 mm. (*i.e.*, nearly 8-10th inch). (C. Sasaki.)*

It has been remarked concerning *Diaspis amygdali* (*D. patelliformis*, Sasaki), and it doubtless applies to other Armoured Scale Insects, that "After the winged insects have appeared they remain generally near the cocoon a little while, and then crawl about the female scale, or fly in the air to search for the scales." (C. Sasaki.)

With regard to the time occupied by scale insects in effecting their metamorphoses, or paramorphoses, little has been ascertained, and the present writer is unable to bring any personal knowledge to bear on the subject. Messrs. Howard and Marlatt have stated that the young of the San José Scale assume the pro-pupal stage† eighteen days after they have been born; in two days more becomes true pupæ; and finally hatch out when from twenty-four to twenty-six days old. The female insect, they report also, shows fully formed young within it when twenty days old, and these have hatched out in from twenty-four to twenty-six days from the birth of their parents. They thus determine the length of a generation—which is obviously identical with the duration of the female insect's existence—as on an average thirty days.‡ Dr. L. Zehntner gives the time occupied during each stage of existence in both sexes of *Diaspis sacchari-folii*. For the male insect this amounts to twenty-four, and for the female from twenty-eight to thirty days.§ It must not, however, be concluded that this estimate necessarily applies to all Coccidæ. With some species this time limit may be lengthened, in others shortened. Again, a low temperature will exert its influence in retarding development, and *vice versâ*.

From what has been already alleged regarding the relatively long period occupied by the female insect in giving birth to its young or in depositing its eggs, it may be inferred that there is a considerable overlapping of generations, so that is difficult to estimate the number of these occurring during a season or any lengthened period. But from the number of eggs or young arising from a single female insect, and the short time required for a generation to arrive at maturity, this may be readily surmised.

It would appear that the number of males comprised in successive generations throughout the year varies. This has been shown to be the case with *Aspidiotus perniciosus*, by Messrs. L. O. Howard and C. L. Marlatt, as the outcome of actual observation conducted by them; their remarks relating to this subject, and to the increase of the notorious insect mentioned, being as follow:—

Perhaps the most notable feature of the foregoing records is the result obtained from the over-wintered females. It will be seen that the males greatly predominate in this generation, and that the numbers of both sexes are insignificant compared with the progeny of the later generations. The males still predominate in the second generation, but in the third and fourth generations the females considerably outnumber the males, in one instance the females from a single mother reaching the astonishing number of 464, which with 122 males from the same parent makes the progeny of this female 586 insects. Taking 200 females as an average of the

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* For exact information regarding the transformations undergone by the sexes of particular species of armoured scales, the reader is referred to the memoirs of Howard and Marlatt, Sasaki, and Zehntner, already cited.

† These authors distinguish between a pro-pupa and pupa stage. The former of these is distinguished by small wing, antennal, and leg-sheaths, and by an absence of any indication of abdominal style. A. Berlese, however, merges the two into a single pupa, or rather second nymph—as he prefers to regard it—commenting on the gradual growth and appearance of these organs without ecdysis.

‡ *Op. cit.*, pp. 40-42.

§ Die Plantenluizen van het Suikeriet, op. Java. *Op. cit.*, pp. 16-17.

different generations for the year, the product of a single individual from spring to fall amounts to 1,608,010,200 females. In one instance we have over 415 males from a single female, and while the number of males would average somewhat less than the females, taking the summer through, yet, having underestimated the females, the males may be estimated at the same number, giving a total of 3,216,080,400 descendants from a single insect in a single season. It is not to be expected, of course, that all the individuals from a scale survive and perform their function in life, but under favourable conditions, or in the case of a tree newly infested, or not heavily encrusted, the vast majority undoubtedly go through their existence without accident. Wherefore neither the rapidity with which trees become infested, nor the fatal effect which so early follows the appearance of this scale insect is therefore to be wondered at.*

With reference to the nature of the injury occasioned by Scale Insects to plants, it may be remarked that there are grounds for concluding that this does not exclusively consist in the extraction of so much cell-sap, and the consequent deprivation of the vegetative or reproductive parts of the service that it should otherwise render them. For they no doubt originate also chemical changes that may have more than a local prejudicial effect. In the case of many of the Armoured Scales it may be commonly remarked that the foliage that is infested by a particular species has its green colouration in great measure discharged at spots where individuals are attached. The San José or Pernicious Scale when it occurs on either the apple or the peach—and the observation is applicable to fruit as well as foliage—occasions a very distinct reddish-purple spot. Again, other Scale Insects—*e.g.*, Mealy Bug (*Dactylopius*) often occasion contortion of foliage where they occur, whilst others give rise to galls. These phenomena, it is considered, do not merely arise from mechanical influences due to the feeding habit, nor can they be attributed to atmospheric agencies brought into injurious relation with the tissue of the plant as a consequence also thereof. Again, it may be inferred from observation also that there is a special condition of the plant *cæteribus paribus* favourable to the increase of whatever scale insects may accidentally become established upon it.†

There is, in conclusion, another form of injury that may be ascribed to certain Scale Insects, though not, it is true, exclusively arising from their presence. This consists in the occurrence upon plants infested by them of a more or less dense black investment that may even extend to the ground beneath their branches. The presence of this is accounted for as follows:—These Coccidæ possess the habit of excreting forcibly from a special terminal organ a gummy saccharine fluid that may be shed over the entire surface of the leaf immediately beneath that upon which they are stationary, or even upon the bodies of their fellows located thereon. This sweet substance on its part forms a congenial home for, and is soon occupied by, more than one species of epiphytal fungus. These, that are characterised by the possession of almost black or rather dark olivaceous spawn threads and reproductive organs, constitute, when growing thickly together, a soot-like encrustation that bears the appropriate name of "fumagine" (Lat., *fumago*, soot), and that may be recognised on scale-infested trees, even when the observer is located at a considerable distance therefrom.‡ This habit is manifested by Mealy Bugs, by Wax Scales (*Ceroplastes spp.*), and several other generic forms, but especially by the various species of *Lecanium*, though not equally so by all. The special organ associated with this habit is represented on Plate III., Figs. 11 and 12. In Fig. 11 is shown (*a*) the termination of the intestine or rectum, (*b*) the anal plates or valves, and (*c*) certain muscles that serve to admit of the withdrawal

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* L. O. Howard and C. L. Marlatt. *Op. cit.*, p. 44.

† H. J. Webber, as the outcome of direct experiment, concludes that the "insect diseases [of the orange] are apparently influenced by the use of fertilisers, organic manures rendering the trees more liable to injury from this source than chemical fertilisers."—*Vid. Year-book of the U. S. Department of Agr. for* 1894. Washington, 1895.

‡ For an exact description of the forms of fungus life constituting "fumagine" in certain instances of its occurrence upon scale-infested plants, the reader is referred to D. McAlpine's careful investigations recorded in a paper entitled "The Sooty Mould of Citrus Trees: a Study in Polymorphism," published in the "Proceedings of the Linnean Society of New South Wales." *Op. cit.*, New Series, vol. xxi., pp. 469-499, pl. xxiii.-xxxiv. Sydney, 1897.

or extension of a sack-like organ (*d*), shown exerted in Fig. 12, that is the instrument for the emission in a mistlike form of the particular substance alluded to. The latter act, though it is generally performed spontaneously, is also prompted by the attention of ants that—at least, in *Lecanium*—seem to excite the insect by touching certain appendages or cerci, shown in Fig. 12, with which the excretory organ is endowed.

Although the foregoing remarks may be deemed sufficiently extended to throw some light on a subject that to most people is somewhat involved in obscurity, it must be borne in mind that there are several other equally interesting phases in the life history of Scale Insects that necessities of space forbid being entered into upon this occasion.

DESCRIPTION OF PLATES.

PLATE I.

(*Note.—Each object—except where otherwise stated—is represented with its length and breadth increased 12 times.*)

FIG. 1.—Purple Round Scale—*Aspidiotus ficus*, Comstock: Female Scale. 1*a*, Male Scale.

FIG. 2.—Red Scale—*Aspidiotus aurantii*, Maskell: Female Scale; 2*a*, same as seen from beneath showing—(*a*) ventral Scale, (*b*) eggs occurring between ventral and dorsal Scales; 2*b*, Male Scale.

FIG. 3.—Rose Diaspis—*Diaspis rosæ*, Sandberg: Female Scale; 3*a*, Male Scale.

FIG. 4.—Peach Diaspis—*Diaspis amygdali*, Tryon: Female Scale, smooth form; 4*b*, Female Scale, hairy form; 4*c*, Male Scale, enlarged. (After E. E. Green.)

FIG. 5.—Parlatoria Scale.

FIG. 6.—Glover's Mussel Scale—*Mytilaspis Gloveri*, Comstock: Female Scale; 6*a*, same, as seen from beneath.

FIG. 7.—Fulvous Orange Mytilaspis—*Mytilaspis fulva*, Targioni-Tozzetti*: Female Scale; 7*a*, same, as seen from beneath, showing—(*a*) ventral scale, and (*b*) eggs. 7*b*, Male Scale, both dorsal and ventral views.

FIG. 8.—Apple Mytilaspis—*Mytilaspis pomorum*, Bouche: Female Scale. 8*a*, same as seen from beneath, showing—(*a*) ventral scale, (*b*) eggs.

FIG. 9.—White Orange Scale—*Chionaspis citri*, Comstock: Female Scale. 8*a*, Male Scale.

PLATE II.

FIG. 1.—Long Soft Scale—*Lecanium longulum*, Douglas: Female Scale; diameter magnified 12 times.

FIG. 2.—Soft Scale—*Lecanium hesperidum*, Linné: Female Scale.

FIG. 3.—Soft Scale—*Lecanium depressum?*: Female Scale.

FIG. 4.—Olive Soft Scale—*Lecanium oleæ*, Bernard: Female Scale, showing characteristic ridge; mature, but not elevated as when filled with its progeny.

FIG. 5.—Pink Wax Scale—*Ceroplastes ruber*, Maskell: Female Scale; from specimen of medium size, showing (*a*) respiratory clefts in covering above spiracles.

FIG. 6.—Sida Pulvinaria—*Pulvinaria*, sp.: Female Scale, showing (*a*) egg-sack; diameter magnified 6 times.

FIG. 7.—Cottony Cushion Scale—*Icerya Purchasi*, Maskell: Female Scale, showing (*a*) egg-sack; diameter magnified 6 times.

FIG. 8.—Mealy Bug—*Dactylopius adonidum*, Linn.: Female Scale.

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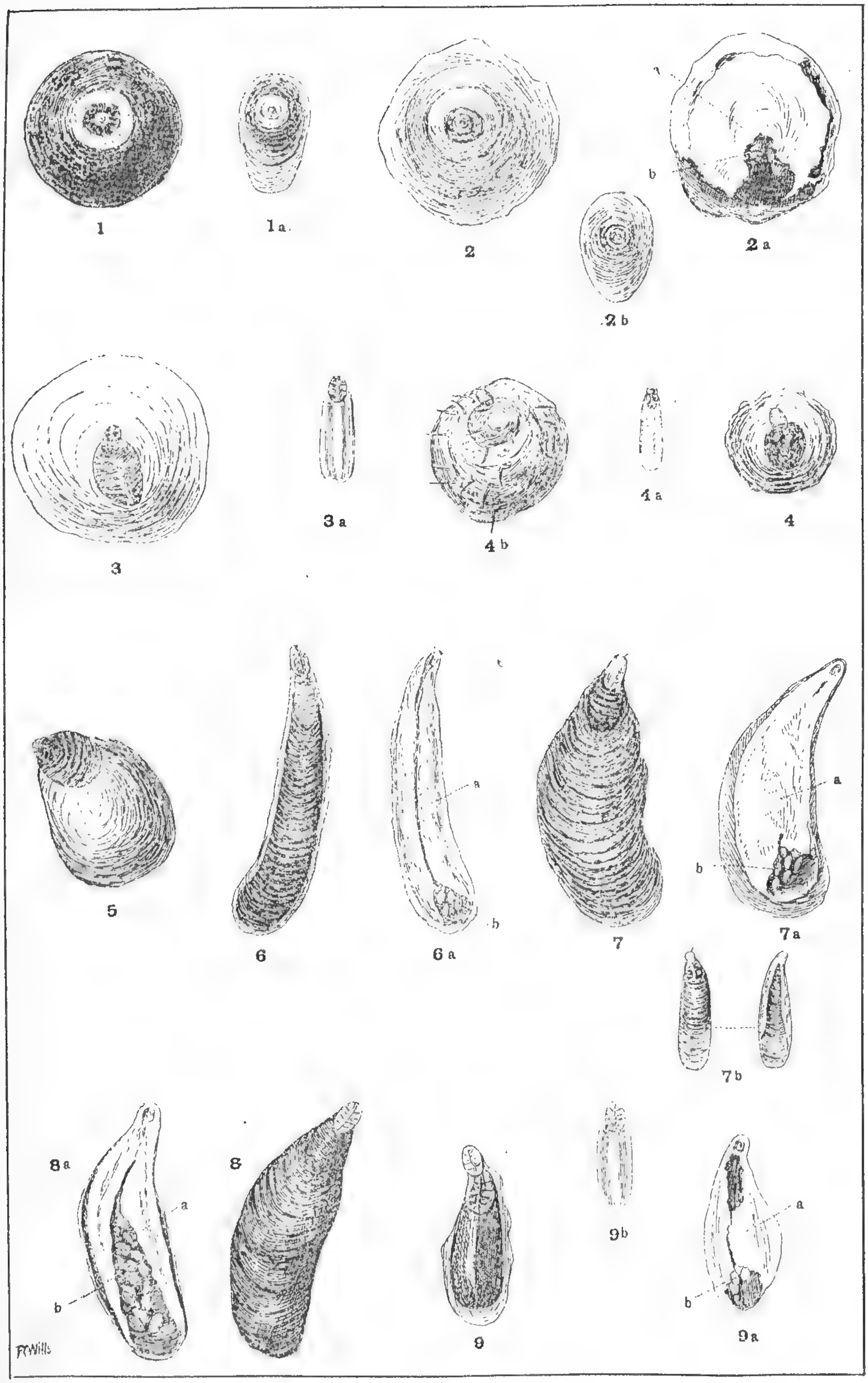
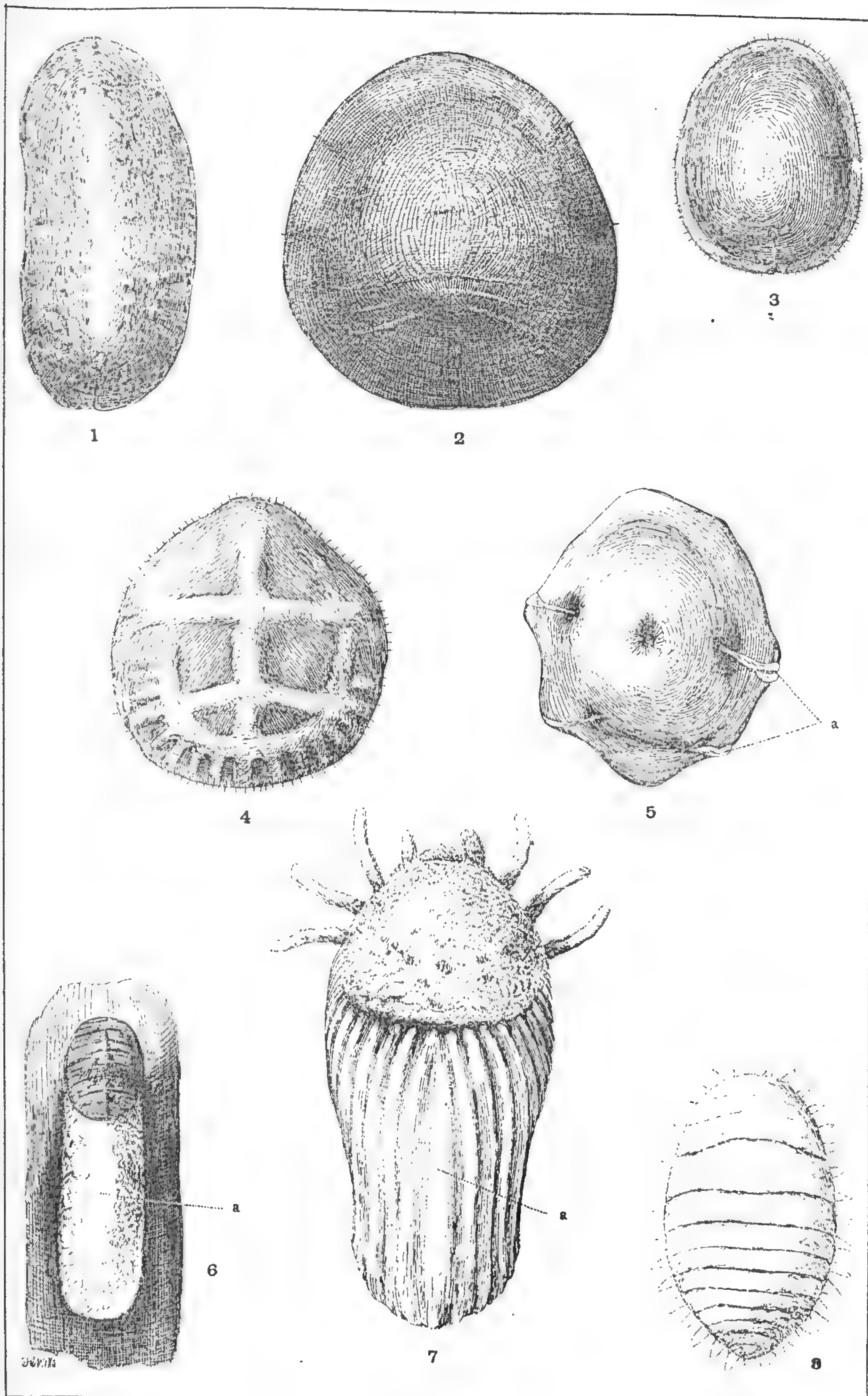
* This insect is usually named in Australia *Mytilaspis citricola*, Packard. But the characters assigned by Packard ("Guide to the Study of Insects, 1870," pg. 527) for his *Aspidiotus citricola* are so meagre as to be insufficient to distinguish his species from *Mytilaspis pomorum*, B.—a Scale Insect also occurring upon citraceous trees. The writer therefore adopts the name under which the first recognisable description was published, and in doing so follows A. Berlese and other authors.



SCALE INSECTS—COCCIDÆ.



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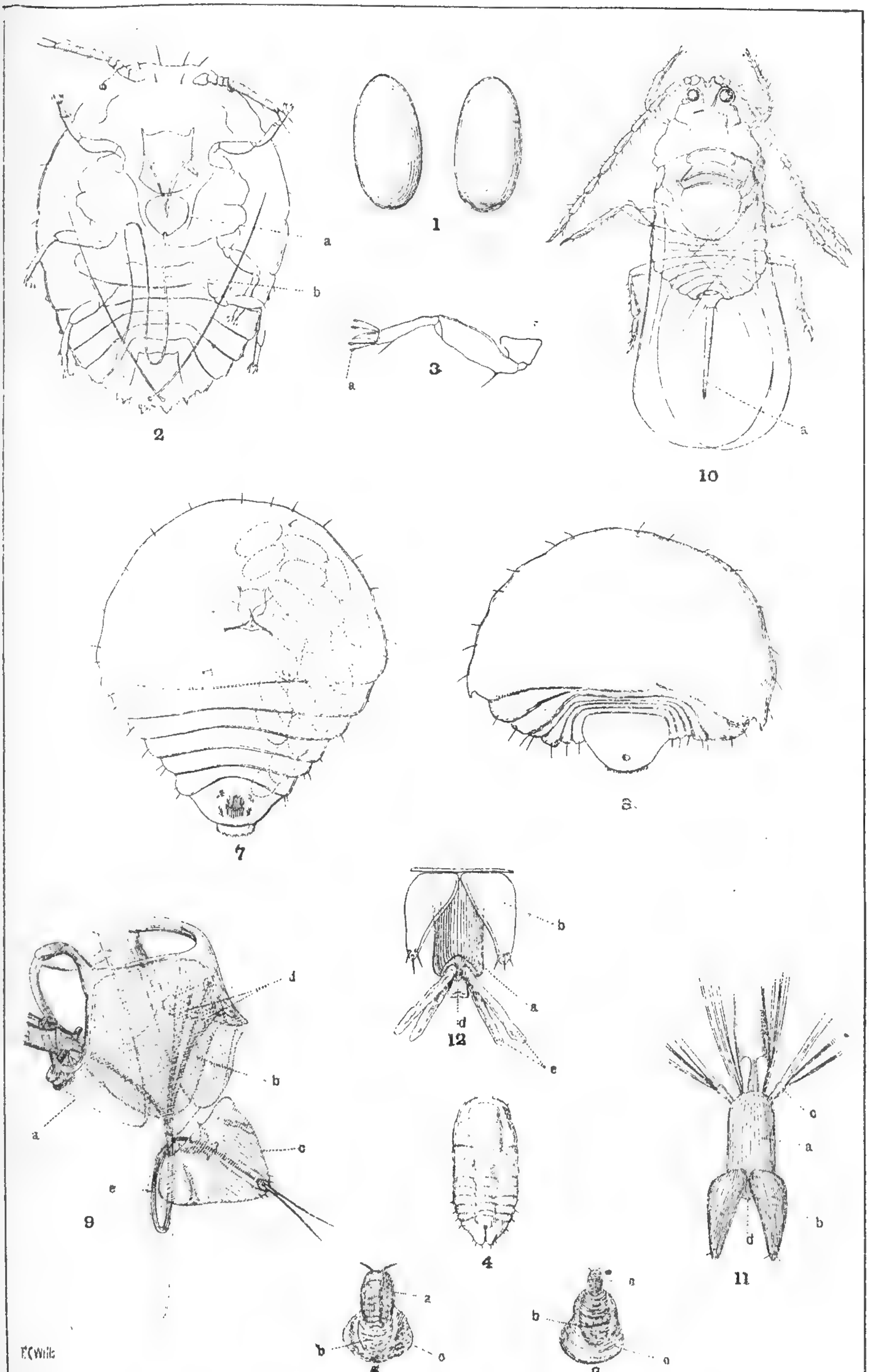


SCALE INSECTS—COCCIDÆ.

PLATE III.

FIG. 1.—Eggs of Purple Round Scale—*Aspidiotus ficus*, Comst.; magnification, $\frac{96}{1}$. (After Berlese.)

FIG. 2.—Larva of same; seen from beneath—(*a*) succhiatoio or sucking lip, and (*b*) maxillo-mandibulary seta or rostrum; magnification, $\frac{108}{1}$. (After Berlese.)

FIG. 3.—Leg of larva of same, showing (*a*) tenent hairs; magnification, $\frac{340}{1}$. (After Berlese.)

FIG. 4.—Larva (female) of *Diaspis sacchari-folii*, Zehntner, that has become fixed; magnification, $\frac{48}{1}$. (After Zehntner.)

FIG. 5.—Young female of the same, after first molt, when it becomes nymph No. 1; showing—(*a*) skin of original larva, (*b*) insect beneath and extending beyond this, and (*c*) secreted shield being formed by latter; magnification about $\frac{24}{1}$. (After Zehntner.)

FIG. 6.—Young female of the same after second molt, when it becomes nymph No. 2; showing—(*a*) skin of original larva, (*b*) skin of nymph No. 1, and (*c*) secreted shield in process of formation; magnification, $\frac{9}{1}$. (After Zehntner.)

FIG. 7.—Female of Round Purple Scale—*Aspidiotus ficus*, Comst.—distended with eggs; magnification, $\frac{39}{1}$. (After Berlese.)

FIG. 8.—Female of same, immediately subsequent to parturition; magnification, $\frac{39}{1}$. (After Berlese.)

FIG. 9.—Mouth-organs of Olive Soft Scale—*Lecanium oleæ*, Bern.—showing—(*a*) clypeus, (*b*) hypo-stomal plate, (*c*) mentum or "succhiatoio," and (*d*) roots of maxillo-mandibulary seta or proboscis; magnification, $\frac{210}{1}$. (After Berlese.)

FIG. 10.—Male of Round Purple Scale—*Aspidiotus ficus*, Comst.—as seen from above, showing (*a*) abdominal spike enclosing external sexual organs; magnification, $\frac{57}{1}$. (After Berlese.)

FIG. 11.—Organs terminating abdomen of female of Soft Scale—*Lecanium hesperidum*, Linné—showing (*a*) rectum withdrawn, (*b*) anal plates or valves, (*c*) retractor muscles; magnification, $\frac{75}{1}$. (After Berlese.)

FIG. 12.—The same, showing (*a*) rectum, (*d*) protrusible sack, and (*e*) anal cerci or appendages; (*a*) and (*d*) being exserted for the purpose of emitting sugary gum-like fluid; magnification, $\frac{75}{1}$. (After Berlese.)

Apiculture.

BEE-KEEPING FOR EXTRACTED HONEY.

By H. STEPHENS.

Part II.

THE WORKER.

The worker bee, as its name implies, does all the work in connection with the hive, and is a fine example of what united industry can accomplish. A worker bee hatches in about twenty-one days from the time that the egg was laid, and the first thing it does is to dip its tongue into a cell of unsealed honey, and will begin to help feed the unsealed larvæ. When a week or ten days old, they will take their first flight outside and bring in their first load of pollen, and when a month old they are at their best as honey-gatherers. The average age of the worker bee is (during the summer) about three months, and at the height of the honey season it is only six or eight weeks. The worker bee or neuter is an imperfect female, and in exceptional cases has the power of laying eggs, as in the case of a fertile worker. It is also provided with a sting that is barbed like a fish-hook and prevents its withdrawal from the wound, and at the other end is the bag that holds the poison which gives the unpleasant feeling when the sting is inserted. It is said that bee-stings are good for rheumatics. The bee does not breathe out of its mouth, but by means of fourteen little openings called spiracles. Ten of these are in the abdomen—five on each side, the other four being on the thorax—two on each side; so that if a bee is placed in a cup of water, even if its head be out, it will be drowned. In the worker bee, the proportion of the brain to the body is $\frac{1}{174}$ part; in the ant it is $\frac{1}{286}$; and in man about $\frac{1}{40}$; the worker bee having the largest brain among the insects.

ABOUT QUEENS.

A queen bee is hatched from a worker egg in sixteen days from the time the egg was laid, and in a vertically suspended cell which is marked on the outside with miniature corrugations, something resembling a thimble. It may happen that a colony has no worker eggs or larvæ with which to raise a queen. They will then attempt to rear one with drone eggs; but if the drone dies before it is hatched, or if the cell does hatch, it produces only a drone. The bees do not mark the sides of the cell that has a drone, but leave them smooth, so that it can be seen to be no good, and they provide another cell. After the queen hatches out she has a taste of honey, and then looks for other queen-cells and destroys them; or if another queen is hatched at the same time both will fight until one kills the other, except (as mentioned previously) in the case of after-swarms. Then for the first week she is always travelling about the combs, and at about the end of that time she will go outside and try her wings a little, usually at the warmest part of the afternoon, and she is very careful in taking the bearings of the hive. After she is satisfied that she knows the place, she will fly right away, and in about half-an-hour, more or less, will return with the organs of the drone attached to her body, which are either absorbed or fall off. Then in about three days more, or on an average when about eight or ten days old, she will commence laying.

CUTTING QUEENS' WINGS.

Some bee-keepers practise the plan of clipping the queen's wing after she is fertilised, in order to prevent her leaving with a swarm; and as no swarm will leave without a queen, it lessens the chance of losing it if the queen's wing is cut, for the bees will return to the hive on not finding the queen with them; but if the bee-keeper do not happen to see the bees swarm the plan loses its advantages, as they will probably swarm out with a young queen from one of the queen-cells. But where the bees can be seen to swarm, clipping the wings of the queen is convenient sometimes, as all that has to be done is to cage the queen as she is hopping about the entrance to the hive; and then to move the hive to a new location, putting a new hive with frames of foundation or empty combs in its place, and, when the returning bees are going in nicely, to release the queen and let her go in with them. If it be not desirable to move the old hive, the caged queen may be tied on to a small branch and held near the swarm, when they will soon cluster on it, and may be carried to where they are wanted.

INTRODUCING QUEENS.

It sometimes happens that it is wished to change the queen—say, to give a hive of black bees an Italian queen, or to replace one that has been lost. To do this, the inferior queen must be removed, and the other introduced by means of an introducing cage, for if the new queen is placed directly in the hive the bees will very likely kill her by what is called "balling the queen." But when put in a cage, the bees will liberate the queen themselves by eating out the candy that is in one end of the introducing cage.

DIRECT METHOD OF INTRODUCING.

There is a way to introduce the queen without the use of a cage, and is as follows:—Remove the old queen, and keep the one to be introduced in a cage by herself and without food for several hours; then about twenty-four hours after removing the old queen, and at about 9 o'clock in the evening, go with a lantern to the hive, and gently lift off the cover and allow the new queen to run down between the combs.

ITALIAN BEES.

Points of Superiority.

1. They possess longer tongues, and so can gather honey from flowers that are useless to the black bee.
2. They are more active, and with the same opportunities will gather much more honey.
3. They work earlier and later. This is true not only of the day but of the season.
4. They are far better able to protect their hives against robbers.
5. They are almost proof against the ravages of the bee-moth larvæ.
6. The queen is decidedly more prolific.
7. The queen is more readily found.
8. The bees are more disposed to adhere to the combs while being handled.
9. They are less liable to rob than other bees.
10. And they are far more amiable.

Pure Italian bees should have three yellow bands on the abdomen, although the first band, next to the thorax, is sometimes difficult to see; but a fair test of the purity is the uniformity of the markings of the worker bees of a whole colony.

BEES NOT TO BE FED NEAR HIVES.

Bees should not be fed with honey or sugar near their hives, as it may start them robbing, and this is specially the case when there is a scarcity of honey; but the food should be put some distance away and not in large quantities in

deep vessels, but spread it out on a board or on the grass, as otherwise numbers of the bees will get stuck in the honey or other food and be suffocated. If the bees are seen fighting at the entrance to their hives, it may be suspected that others are trying to rob; and if it is a weak colony that is attacked, it is best to contract the entrance. Bees may be fed inside the hive, and this is the right way to give a colony sufficient stores for the winter, and there are several ways of giving it to them. A couple of frames of honey may be taken from some colony that has plenty, or a shallow frame may be made the same size as the body of the hive and about 2 inches deep, with a bar across the centre to support the mat; then a plate of honey or sugar may be placed on the frames, and the bees will soon carry it down.

MOVING BEES.

A hive of bees cannot be moved about anywhere, especially where there is more than one; but if required to be moved it must be shifted only a few feet at a time, as when a hive is first placed in position the bees take their points from surrounding objects, and if the hive is moved they will not be able to find it, and may try to get into the next one, when they will be killed by the other bees. If it is necessary to move a hive, it must first be carried out of the radius of the flight of the bees, which is usually two to three miles, and after about a fortnight brought back to the place where it is required. A new swarm may be placed anywhere.

ARTIFICIAL SWARMING.

To prevent the chance of the bees getting away when swarming naturally, artificial swarming is sometimes resorted to, and is accomplished in several ways, of which the one given below is good: Go to a hive and get a comb with a queen-cell on it, putting an empty comb or frame of foundation in its place; then remove the hive that you wish to swarm artificially to a new position, including the super, and put a new hive with empty combs or frames of foundation in its place, putting the frame with the queen-cell among them; then the returning bees will soon make a good swarm. It is as well, instead of all empty combs, to give some frames of eggs and brood from the old hive, and then the bees will have something to do while waiting for the cell to hatch and the young queen to lay. Another way is to give the new colony a frame with the queen on instead of a queen-cell, and this is perhaps a better method than the first.

WINTER CARE OF THE BEES.

Most people commencing bee-keeping will get along all right during the summer months, but it is in the cold weather that the bees require most care, as it is the hives that come out strongest in the spring that gather the first surplus honey, so winter should be entered on with the bees as strong as possible, and any that do not cover more than four frames should be joined to some other colony keeping the better queen of the two. Care should be taken to see that they have sufficient stores and are not likely to be starved out, but in most places in this colony the bees will be able to gather a little honey for themselves during some warm days in winter. Division boards are useful to economise the warmth of hive by contracting the space, and are made of 1-inch stuff and a little larger than a frame, and hang from the rebate of the hive. One is placed on each side of the cluster; an extra mat should also be put on, and, of course, the super taken off. The bees should be looked at occasionally, and a warm day chosen for the purpose.

EMPTY COMBS.

Before the cold weather comes the supers will be taken off, and the combs stored away where rats or mice cannot get at them; the hives themselves do very well to keep them in, and may be placed one on the other and the top one covered. The combs should be looked at from time to time to see that there

are no bee-moth larvæ in them, as they will spoil the combs if not prevented. The way to get rid of them is to burn some sulphur underneath the frames, first stopping up any crevices that the fumes may not escape. Spiders and bee-moth, with, perhaps, ants in some places, are amongst the worst enemies of bees.

WATER FOR BEES.

A dish of water placed a few yards from the hive is desirable, as it sometimes saves them going a considerable distance for it, and during early spring and autumn, or when they are rearing brood largely they use large quantities of water. A few pieces of stone or cork will give the bees the requisite foothold.

EXTRACTING HONEY.

After removing a super full of honey, it should be taken to the honey-house or a place where the bees will not bother you when extracting. The combs should then be uncapped over an uncapping can or a tin dish, with small holes punched in the bottom to let the cappings drain through. If a strong hardwood bar is fastened across the dish, and a spike made out of a large nail and sharpened to a point is put in the centre, the combs may be turned on it and either side uncapped easily. After two combs are uncapped, they are put into the honey-extractor, and a few turns of the handle will take out the honey. They are then turned and the honey taken from the other side, and so on till all the combs are done. After the honey is extracted, the combs are returned to the bees to fill up again. When the honey in the extractor reaches to the bottom of the cage, it has to be strained, but the extractor must first be lifted so as to get a cask or tin under the honey-gate or tap, and a pair of pulleys attached to a beam overhead is convenient; then when the extractor is at the right height tie a bag made of cheese or butter cloth round the tap, and strain into the honey-tank; or, a better way is to have the strainer right on the tank itself by having a rim of tin about 2 inches high and say 6 inches in diameter above the top of the tank; then put the strainer bag through, and clasp an india-rubber ring round it to hold it in place. It is possibly better not to store the honey in too large tanks, but those that hold a moderate quantity, say 2 cwt.—as the various qualities of honey may be kept separate, and the weight is not too great to handle easily. It is a good plan to have hardwood legs to the tanks, bolted on, and then if the ants give trouble they may be stood in tins of water.

APPLIANCES REQUIRED IN BEE-KEEPING FOR EXTRACTED HONEY.

Honey-extractor.

A honey-extractor is indispensable, and one that holds two frames is large enough for most people, and is the one most generally used. It is made of good heavy tin, and is 17 inches in diameter and varies in height; but 26 inches at the top and 25 at the opposite side is a good height in which there is room beneath the cage for 60 lb. of honey, which is a great convenience, for one of less depth has to be worked with the honey-gate open, and is only a few shillings cheaper. The former would cost £2, and the smaller one 35s.—both are best if fitted with bevel gearing. The principle on which the honey-extractor works is what is called centrifugal force, or the tendency of all revolving bodies to fly away from the centre. The discovery was made in a very accidental manner by Major Francesco de Hruschka, of Venice, in Italy, in the year 1865. He was working among his bees, and saw his son whirling a basket at the end of a piece of string in which he had put some pieces of honeycomb. The centrifugal force caused the honey to fly out through the bottom of the basket; and the father went and made a rough extractor, which has been improved on from time to time by others, and is now the handy machine of the day. For very large apiaries the two or three frame-reversible extractors are quicker, as the combs are turned by reversing the handle of the machine.

Uncapping Can.

Before the honey can be extracted the caps of the cells must be shaved off, and for this some kind of uncapping can is required. The one supplied by dealers in bee-keepers' supplies is made of strong tin and is in two parts, the upper part sliding into the lower, and has a screen of wire cloth on which the cappings fall and drain down below, from which the honey is drawn by the tap. The price is about 30s., but a good substitute may be made of a large-sized tin dish and punching small holes in the bottom, and then stood inside a tin bucket. A strong bar of hardwood fastened across the dish, with a sharp spike in the centre of bar to turn the frames on, is sufficient for anything, and would only cost 5s.

Honey-tanks

May be made any size, but those that hold about 2 cwt. of honey—which would be a tin 17 inches in diameter and 18 or 20 inches deep—are preferable. Barrels may be used, but are sometimes liable to leak, and are more troublesome to fill and empty, but they are strong and easily handled if not more than 15 gallons in capacity. The bottom of tin honey-tanks should have an inclination of about an inch towards the tap to facilitate the flow of the honey.

Uncapping Knives,

Of which there are several kinds, are necessary to cut the caps off combs. They are made of good steel, and will last a lifetime. The Bingham is a very good one, and the price is 5s. A mason's trowel, if ground sharp, will make a fair substitute.

Queen Excluders or Zinc Honey-boards.

On every hive between the super and brood-nest is placed a queen excluder or honey-board. Its object is to prevent the queen coming into the super and laying eggs there; also to keep the drones down below, the perforations in the zinc being too small to admit either queen or drones. It is best to put a frame of wood round the honey-board, and a bee-space on each side is preferable, as the excluder may be put on either way. The price of one in a frame would be 2s. 6d., and about 1s. without.

Bee-escapes or Super-clearers

Are used to clear the combs of bees when extracting. They are a great convenience, and save all the trouble of brushing the bees off each comb; they will only clear combs that have honey in them, as if any have eggs or young brood in them the bees will not leave the combs. The Porter bee-escape is one of the best, and costs 1s., or, if fitted in a board, 2s. 6d. Anyone who has once used them will never be bothered brushing the bees off the combs again, and that will last for several seasons.

Smokers.

To work with bees a good smoker is necessary, and there are several kinds to choose from, either on the hot or cold blast principle. In the hot-blast pattern the air is blown through the fire, and the Bingham smoker is one of that kind, and with this sort a large volume of smoke can be obtained; but sometimes sparks will blow through as well, which is unsatisfactory. In the cold-blast pattern the air is not blown through the fire; and the Clark smoker is a good example of one, and is the smoker most generally used, and also the lowest priced, being about 4s. 6d. The latest smoker on the market is the Corneil, which has a bent nozzle and other improvements, but the price is rather high. For fuel for the smoker, rotten wood, saw-dust, rag, &c., is good; and for convenience in lighting, a small oil-can, filled with kerosene, is handy, as a few drops sprinkled on the fuel will start the fire at once.

Introducing Cages.

Small wire-cloth cages for holding the queen and for introducing are very handy in the apiary; and Miller's introducing cage is as good as any, as if in a hurry the queen may be liberated by putting the cage in at the entrance of the hive, it being only three-eighths of an inch thick, and the bees will let the queen out by eating out the candy. Other cages combine a shipping cage with the introducing one, such as the Benton and one or two others. Colonies that have been queenless only a couple of days are the easiest to introduce a new queen to, and special care must be taken that they have no other before attempting to give them one.

Bee-veils.

Are used by most people, and are made of a piece of mosquito-net, with a piece of black tulle sewn in the part that comes in front of the eyes, as the black is more easily seen through. A piece of elastic is threaded in the top edge of the veil to clasp round the crown of the hat, as it is better than sewing the veil directly on the hat, for when soiled it may be removed and washed. Some veils have a piece of wire cloth or a small plate of glass in front of the eyes; but it may be uncomfortable to wear, though no doubt slightly easier to see through.

Everything necessary to enable an apiculturist to keep bees successfully has been set forth. It only remains to give a few short rules on good management:—

1. Keep your bees strong.
2. Don't feed bees near hives, or you may start robbing.
3. Give extra care to bees in cold weather, and see that they have sufficient stores.
4. Don't let colonies get queenless without having means to raise another.
5. Keep the hives and appliances in good repair, keeping covers from leaking, and repainting hives when they require it. If these things are done outside the hive, and the bees looked after on the inside, you will have no occasion to regret starting to keep bees, but make the bees keep you.

A Tropical Industry.

INDIA-RUBBER (CAOUTCHOUC).

Part II.

By E. COWLEY,

Manager, Kamerunga Nursery Cairns.

John Haddon and Co., the proprietors of the *Produce World*, in their issue of 15th November, 1895, give the following then market values of India-rubber :—

	Per lb. s.	d.		Per lb. s.	d.
Para, fine	3	4½	to	3	6
Negrohead	2	1	,,	2	5
Columbian, good to fine ...	2	3	,,	2	9
Madagascar, good to fine ...	2	2	,,	2	5
Niggers	1	5	,,	1	7½
Mozambique, good to fine ...	2	2	,,	2	5
Assam and Rangoon	0	9	,,	2	2
Borneo and Rangoon	1	3	,,	1	9
Penang, Java, &c.	0	9	,,	2	2

It is to be regretted that in this list of prices, Ceara rubber is not mentioned, but it will be noted that Para obtains much the highest quotation. On the subject of India-rubber, the last edition of the "Encyclopædia Britannica" has the following :—"It would seem that Para rubber, in the form of 'biscuits' rarely contains more than 15 per cent. of moisture. The scrapings from the tree, which contain fragments of wood, are mixed with the residue of the collecting pots and the refuse of the vessels employed, and are made up into large rounded balls which form the inferior quality called 'Negrohead.'" Rubber in this form is quoted by John Haddon and Co. at about 1s. less per lb. than "Para, fine"; it often contains 25 to 35 per cent. of impurities. Previous to 1860, Para rubber was exported only in small quantities, and then chiefly in the form of "shoes." This variety ceased to be sent to market in 1852. "Negro-head" has been exported in grotesque forms of animals, &c. The cultivation of Para rubber has been attempted in India, but that country does not seem to have had a suitable climate; it, however, grows fairly well in Ceylon, Malabar, and South Burmah.*

Ceara rubber comes almost next to the Para in value, as it is a dry rubber and very elastic, and is free from stickiness, but it often contains a quantity of wood and foreign substances arising from the mode of collecting it. The loss in washing previous to manufacture amounts sometimes to 25 per cent. It is the product of *Manihot Glaziovii* Mill. Arg., a Euphorbiaceous tree common in the province of Rio Janiero. Baron von Mueller, in his excellent work, "Select Extra-tropical Plants, 1888," says of this plant :—"*Manihot Glaziovii*: A native of Ceara, a coast district of Brazil, in latitude 4°,

* In the Botanic Gardens at Palmerston, in the Northern Territory of South Australia, rubber flourishes luxuriantly. There it is intended to go into the business in a wholesale manner, and the Government will shortly throw open lands for rubber cultivation, under conditions which possibly may bear some affinity to the old sugar and coffee regulations of this colony.—Ed. *Q.A.J.*

possessing a climate arid for a considerable part of the year. This tree is evidently of a comparatively hardy character, and adapts itself readily to the exigencies of culture (D. Morris). Thrives well as far south as Durban, in Natal (J. M. Wood). It produces the Ceara rubber. Its cultivation is not difficult, and its growth remarkably rapid. It could only be grown in regions free from frost. Mr. Holtze, at Port Darwin, had the first grand success with this plant in Australia, seeds from Kew Gardens having been placed by the author (von Mueller) at his disposal; his plants attained a height of 12 feet in little more than a year. Perhaps the plant must be regarded as strictly tropical. Still, near Port Curtis, at the verge of the tropics, it grows fast and matures seeds; the trees there already are over 20 feet high (Edgar). In Ceylon it thrives up to 3,000 feet elevation, content with poor dry soil (Dr. Trimen). Easily reared from seeds or propagated from cuttings; the germinating is expedited by filing the shells of the seeds and placing them in coir; when sprouting, they should be put into the soil with the germ downwards. In Ceylon the plant has grown as much as 20 to 30 feet in two years; the plants should be placed about 10 feet apart. It is best to delay tapping till the trees are five years old (Keir Leitch)." In the Ceylon *Tropical Agriculturist* of the 1st July, 1884, Mr. J. B. Ferguson says:—"I have lately been making experiments in the growth of Ceara rubber. It seemed to me that the tedious operation of filing each seed might be done away with. I am glad to be able to inform you that my experiments have been crowned with success; by my method the attack of ants need not be guarded against. Put into a shallow box (a brandy-case will do) about two or three inches of fresh horse-dung, first removing any loose straws, &c.; spread it out smoothly, and lay the seeds rather thickly on it. Cover the seeds with the same number of inches of the same material. The seeds germinate in a week or ten days; transplant into a nursery, and afterwards to the field," &c., &c.

The seeds of *Manihot Glaziovii* germinate very freely if allowed to remain as they fall from the tree, and from this spot may readily be removed to the site where they are intended to form a grove. Like most of this family, it strikes readily from cuttings; it is, however, of a brittle nature, and will not stand severe winds, and should therefore be planted in sheltered localities or otherwise provided with breakwinds. The trees planted at Kamerunga State Nursery have done excellently well, and this year a considerable number of seedlings appear beneath the older trees. A number have been planted out, and it is the intention of the overseer to form a grove of these trees, so as to be able to supply the general public with unlimited plants and cuttings. The tree possesses some points of beauty, and might be planted in school grounds together with *Ficus elastica*, and so form object lessons for the scholars. Mr. J. Midley Wood, in his "Guide to Trees and Shrubs in the Natal Botanic Gardens, 1897," makes the following mention of *Manihot Glaziovii*, J. Muell:—"Nat. Order Euphorbiaceæ. This is the tree that yields the 'Ceara' rubber of commerce, a tree of rapid growth, and fit for tapping in about five years. Our trees were reared from cuttings, and will therefore never make symmetrical trees; but they bear seed in abundance. This tree is extensively grown on the East Coast (Africa), and will not pay in Natal, as the labour is far too expensive. The plants were reared from cuttings of a tree imported in 1870."

Mr. Wood, in his remark that it (*Manihot Glaziovii*) will not pay in Natal, furnishes food for reflection to Queenslanders. If it will not pay in Natal, where labour is comparatively cheap (12s. to £1 per month with rations for Indian coolies), it will hardly pay here, where wages are so much higher. It may, however, be urged that the colony of Natal is outside the tropics, and that it does not possess large areas of waste land such as exist in Queensland. It is quite possible that Mr. Wood's data has been founded on a few trials made upon the specimens in the Botanic Gardens at Durban, and he can hardly have intended his statement to be so sweepingly condemnatory as it reads.

Professor Shelton once said to the writer, "Your failure is really a success." Failures are not pleasant experiences. The plant *Manihot Glaziovii* will receive a fair trial in this tropical part of Queensland, and the results will be made known in the usual annual reports of the Department. There is some disparity in the statements as to the age the tree should attain before it is tapped. According to Mr. R. Cross:—"The trunk should have obtained a diameter of four or five inches—*i.e.*, when the tree is about two years old. The mode of collecting the rubber is as follows: After brushing away the loose earth and stones from the roots of the tree by means of a handful of twigs, the collector lays down large leaves for the milk to drop upon. He then slices off the outer layer of the bark to the height of four or five feet. The milk, which exudes in many tortuous courses (some of it eventually falling on to the leaves placed to receive it), is allowed to remain on the tree for several days, when it is pulled off in strings, which are either rolled up into balls or put into bags in loose masses, in which form it enters into commerce under the name of 'Ceara scrap.' The amount of Ceara rubber imported into Great Britain in 1879 amounted to 500 cwt. The attempt which has recently been made to cultivate the plant in India has been attended with signal success. In Rio de Janiero it grows in a rocky or stony, arid region, where a short undershrub is the only other vegetation, and the atmosphere is hot and dry, the temperature ranging from 82° to 90° Fahr. It is, therefore, suited for cultivation where the *Hevea* will not grow. In Ceylon it has been found to grow at an altitude of from 200 to 3,000 feet above the sea-level; at Zanzibar and Calcutta it also succeeds well. The seeds have a hard thick coat; take a year to germinate, unless the cornicular projection is rasped off; cuttings, provided they have a single bud, strike readily." It would seem from the above that *Manihot Glaziovii* is peculiarly adapted for the at present unoccupied waste lands of Queensland. As it has been found that the tree will not stand strong winds, sheltered places should be chosen for plantations The attendant labour in connection with the growth and manipulation is all of a light character. The clearing of the area to be planted need not be of a very pronounced kind if the plants are planted about 10 feet apart. The larger trees of the scrub having been felled, *Manihot Glaziovii* will soon assert itself and form a grove in the space of two years that will overshadow most, if not all, indigenous growth. The rapidity of the growth of this plant has been mentioned by some of the writers quoted. The development of the trees at Kamerunga has been quite equal to any of the author's statements. None of the trees have as yet been tapped in a systematic manner, but this will be done, and the results made public later. One thing should be borne in mind: A distrust of sensational reports regarding the culture of this or any other rubber-bearing tree. It may be, however, that rubber-growing in North Queensland will eventually become a very satisfactory factor in the wealth of the nation, but a proper and sure foundation must be first established. This will probably be laid by the exertions of this Department. Most colonists jump at a new thing if there is but the shadow of a chance of its proving to be a correct proceeding. It seems a pity that some reliable record cannot be found of the trial made some years ago at Mourilyan Harbour, near the Johnstone River, where a plantation was once started. What variety of rubber-yielding tree was planted, the writer is unable to state: but about two years ago, when on a Government mission in that locality, he saw nothing but a jungle of native trees on the site chosen for the experiment.

The Divi Divi Tree.

(*CÆSALPINIA CORIARIA*, WILLDENOW.)

By E. COWLEY,

Manager, Kamerunga Nursery, Cairns.

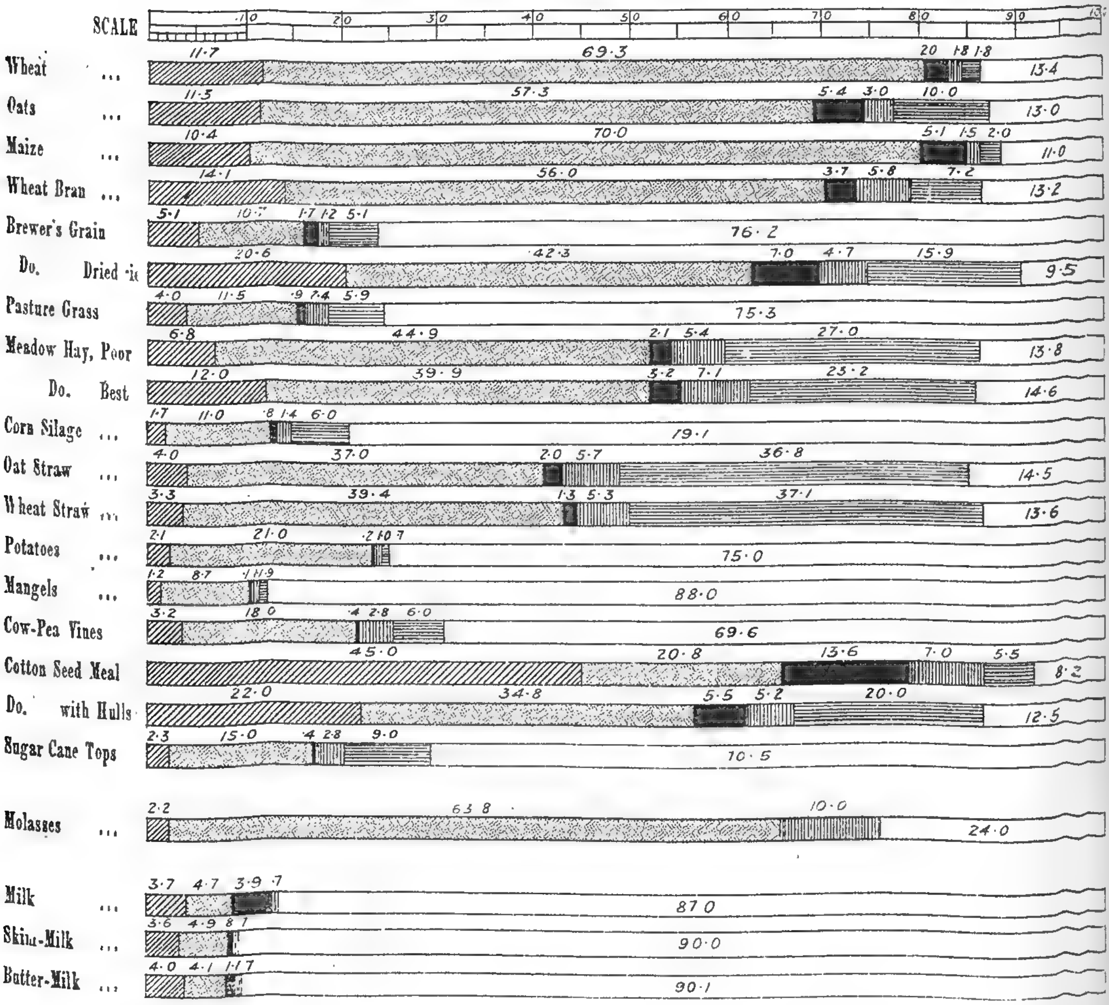
This tree is, perhaps, known better by its vernacular name of "Divi Divi," the derivation of which seems to be obscure. It has, however, a pleasant sound, and seems to have, as the Americans say, "taken on." Seeds of Divi Divi were obtained from the East Indies, and experimented with in North Queensland. The tree, however, is a native of Central America, on the wet sea-shores of which countries it is, according to Baron von Mueller, found indigenous. It would seem, from good authority, and from experiments made at an altitude of about 90 feet in North Queensland, that it is not confined to the sea-coast. Messrs. J. P. William and Brothers, of Henaratgoda, Ceylon, in their descriptive list of tropical seeds and plants for 1897, say:—"The Divi Divi tree thrives on any soil from the sea-level up to 2,500 feet, and begins to bear from the fifth or sixth year, according to the nature of the soil. The produce increases yearly; a net profit of nine rupees per ton per annum has already been derived from twenty-five years old trees." The tree yields curled pods, containing generally one seed only; it is somewhat difficult to dislodge the seed from its covering, which is hard and somewhat fibrous. The seeds once obtained and planted in a shady nursery a few inches apart germinate freely, and when the plants are about a foot high they should be transplanted into the field to permanent places. The distance apart must depend on the quality of the soil, and the purposes for which they are planted. If planted on good soil for a crop of pods, they should be fully 20 feet apart, as at this distance they will be nearly touching each other after five years. Perhaps 25 feet apart would not be too distant; but if planted for the purpose of shading out pestiferous weeds, of which I shall speak later on, they may be planted much closer. The plant is hardy; and if a small area round the stem be kept clear of weeds, the tree will grow and assert itself. It would not seem that the statement made by some writers in regard to its wind-resisting ability in some countries is quite correct, as far as Queensland is concerned. I have seen several trees almost overturned by the very strong winds of North Queensland, but it is by no means a tender-branched plant. The top is very large, but of no great height, and spreads over the area of a circumference of 180 feet, while the topmost branchlet is not more than 15 feet from the ground. The flowers are yellow, and have a very agreeable odour, which, when the tree is in full flower, attracts innumerable insects. Many rare beetles have been found enjoying themselves on them; so that the Divi Divi tree, in flower, affords a good hunting-ground for the entomologist—one where new or rare specimens might often be found. The family Cæsalpinia seems to be a very economic one, and contains many members useful in dyeing, hedge-making, flower bearing, and tanning; Divi Divi is useful in affording by its pods an excellent tanning material. It is regarded in India as the most powerful and quickly acting tanning principle in that country. The dried pods are worth from £10 to £12 per ton in the London market, and each tree is said by Von Mueller to afford 100 lb. of pods per annum when the tree has become mature. Besides tanning, a dye, together with substance for making ink, is obtained from the pods.

This article is, however, more particularly designed to draw public attention to the Divi Divi as a tree with which to clothe areas of land unsuitable to the growths of other, perhaps more valuable, products; and in places where the land has been long neglected, or where weeds abound, or where the land has been overcropped, or, again, where nut-grass predominates—in places such as these—the Divi Divi might be planted, both to redeem the value of the land from the robber and give not a little profit beside. As an ornament it is not to be despised; the delicate pinnate leaves afford with their deep green a pleasant relief to the eye; doubtless with a gardener's care a compact handsome object might be obtained. To plant Divi Divi as a cover and cure for weeds, it would seem that the plants should not be planted at a greater distance than about 15 feet apart; they should be guarded with a small girdle of galvanised iron netting pinned to the ground by hooks made of galvanised iron wire, such as is used for telegraph purposes. This enables the farmer to note the growth of the Divi Divi. The galvanised net rings should be about 18 inches diameter; they can be removed for the purpose of weeding. The weeds in the less immediate neighbourhood can be mowed down, or a scrub-knife may be used to destroy them. After about five years there will not be much growth of any kind beneath the somewhat dense shade of the Divi Divi tree. The first heavy crop may be looked for then. I am told that in Central America the pods are dislodged from the tree by using long light poles. This mode of gathering the crop is very simple, but will not always be possible; but some light bagging might be spread, on which the pods would fall, and thus be more readily secured. The farm barn floor would form a convenient drying-floor. A quantity of these pods, which had evidently been immature when gathered, is to be seen in the Cairns collection of exhibits, International Exhibition, Bowen Park. The season when the crop is quite mature is from the latter end of the month of June to the end of July. It should not be taken, from what has been said in this article in respect to the cultivation of this tree, that imperfect tillage is *best*. The more you can get agricultural implements to work on any land for any agricultural enterprise the better, so that the farmer who best does his work will be sure to get the best results. Mr. Boyd, on the Herbert River, is planting Divi Divi on some sugar lands where *Cyperus rotundus* has a firm hold, and the cultivation of sugar-cane is too expensive to be maintained. Divi Divi seed-pods will be available for distribution after this season's crop is collected at Kamerunga State Nursery.

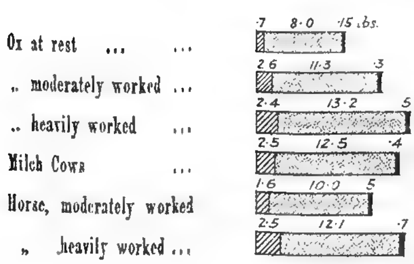
COMPOSITION OF FOODS.

Nitrog. Subst. Carbohydr. Fats. Ash. Fibre. Water.

Figures give the Percentage of each Constituent.



Digestible Nutritive Substances required per day and per 1,000 lbs. Live Weight of Animals, according to Dr. E. Wolff's Feeding Standards.



Composition of Foods.

By J. C. BRÜNNICH,

Agricultural Chemist.

A KNOWLEDGE of the comparative feeding value of the various foods used on a farm is of the greatest importance to every farmer. It is chiefly during the winter months that the scarcity of fodder is more severely felt, but this want would be somewhat relieved, if more attention were given to foods which hitherto have been used only to a very small extent. One of the richest foods, which at present is hardly used at all in this colony, is cotton-seed meal, of which large quantities are produced as a by-product in the cotton-mill near Ipswich. Cotton-seed meal is of special value if it can be used in connection with other poorer feedstuffs. Excellent results have been attained in various of the American experiment stations in using cotton-seed meal in connection with other foods for the feeding of cows, steers, &c.; and as much as 10 and even 12 lb. of the meal per day were given, without having any ill-effects on the animals so fed.

Another of our by-products is molasses, which, although already used for the feeding of horses and cattle in the sugar districts, might be utilised to a far greater extent as cattle food. In the sugar districts molasses is generally mixed with chaff made from the green tops of sugar-cane, and this feed forms the principal diet of the horses and cattle during several months of the year.

Dr. W. C. Stubbs read a paper before the Louisiana Planters' Association, 8th April, 1897, which is reprinted in the *Sugar Journal* of the 15th June, and in which he drew attention to the great value of molasses mixed with cotton-seed meal as a food. Our farmers should make trials with similar mixtures, but, as both these foods are rather laxative, I have to caution against starting with too large quantities at once; and should at any time the bowels of the animals so fed become too loose, some good dry hay should be given to them. Other mixtures of food stuffs are easily made, according to what is readily obtainable.

To enable the farmer to calculate the necessary quantities of various foods for his cattle, I give a table showing graphically the comparative value of the various principal foods, based chiefly on the researches made by Messrs. Dietrich and König. This table also gives the quantities of digestible food required for animals under different conditions according to Professor Wolff's feeding standards. The digestible matter in the various foods is not by any means identical with the composition, and not the whole of the nitrogenous substances (albuminoids, &c., flesh-formers), carbo-hydrates, and fats (both producers of heat and mechanical energy) given in the table are really digestible; also the digestive powers of different kinds of farm animals vary considerably. Bulky foods, as straw and hay, are always better digested by cattle, being ruminants, than by horses. Good lucerne hay and maize are equally well digested by horses and cattle. Pigs again possess a very considerable power of digesting foods. Cooking of foods does not seem to be an advantage; with pigs especially dry foods seem better digested than foods cooked or soaked in water. Generally the only advantage gained by preparing the food by cooking, steaming, &c., is to induce the animal to eat larger quantities of the food.

Farmers' Conference.

At the Agricultural College, Gatton, 10th, 11th, and 12th June, 1897.

FIFTH SESSION.

Friday Afternoon, 11th June, 1897, at 2·15 p.m.

The Hon. A. J. Thynne having taken the chair, questions found in the question-box were at once dealt with. The first was:—I would like to know of a cheap and efficient method of saving the seed of cow pea without injuring the commercial value of the remaining fodder.

In reply, Professor Shelton said the only practicable way he knew of was hand-picking. The crop, of course, could be saved if it was allowed to ripen and then be mown like any other crop of beans; but in this case the fodder was lost, and in any event, the cow pea ripens very unevenly. Again, the cow pea, if handled in the sun, will inevitably shed its leaves, leaving nothing but the stalks, consequently there remains no other method of harvesting it except by hand-picking, which is largely the present practice in North Queensland. The next question was:—Do you think it would be beneficial if the Government would advance loans to farmers under the Credit Foncier system?

Mr. Thynne said this was a very wide question, which was beyond his power to definitely answer. There had been many of these systems, some of which had been successful and some otherwise, in various countries. Taking everything into consideration, it would hardly be wise for them in Australia to jump into following a course, the results of which could not be told with any degree of certainty. Such schemes should be thoroughly studied before anyone could be justified in advocating their introduction into these colonies. With regard to the question of giving greater facilities to farmers for the obtainment of cheap money, which is so often advocated, perhaps a good deal more practical good would accrue to the agricultural industry in this country by its adopting methods of economy such as he had suggested at the beginning of the Conference, and in other matters which could be easily pointed out in connection with every branch of agriculture in the colony. When this was done, and when it could be shown that the farmers could make their farms pay well and continuously, giving a fair average return, year in and year out, their value would be so settled and so increased, that the farm would become an available asset upon which loans could be readily obtained, and there would be little need for interference by the State in the matter of making advances of money of that character. Of course at the present time, the colony was making a big experiment, to the extent of half-a-million of money, in the case of the central sugar-mills. It was sincerely hoped that the scheme would be a success, but whether it would be one or not, was a matter which time alone could decide. It was a gigantic experiment which they were all deeply interested in, but it would not do to hastily decide whether it was a success or a failure. These were matters in which they could go too fast. Where private enterprise was insufficient, then possibly there might be grounds for State interference. But he would urge this upon them —the less they asked from the State, and the less they allowed the State to interfere in the financial arrangements of their business, the better it would be for them eventually.

Mr. J. E. Noakes asked if it was the intention of the Government to establish nurseries for sugar-cane in the Southern, Central, and Northern districts.

Mr. Thynne said he had no hesitation in stating that he had under consideration a scheme for the establishment of one central sugar station and two sub-stations. Where they were to be located and other details, had yet to be considered. In any event he could not go definitely into the matter until he he had received the necessary approval of the scheme from Parliament. He hoped, however, to see these stations established, each of them equipped with competent chemical skill. This latter, he thought, would be necessary for their success.

Mr. T. H. Wells (Isis) then read the following paper on

FARM SERVANTS AND FARMERS.

The difficulty of inducing people to settle on the land is one which is ever before those whose care it is to develop and maintain the agriculture of new countries; and the development is accompanied by an ever-increasing want of farmers and farm labourers.

Of all industries, probably that of agriculture in almost all its forms lends itself most to the profitable employment of individual effort, and the theory of small farmers rests upon an almost unassailable basis were it only possible to find a sufficiency of farmers. Were this the case, the question of settling people on the land would, in such a country as this, be stripped of its greatest and almost only difficulty.

The sugar, coffee, wheat, and some other industries, now slowly growing and capable of almost indefinite expansion, would not only employ an indefinite amount of labour were it available at a certain price, but would also employ a far larger proportion of unskilled labour than most other branches of farming. Of these industries, that of sugar particularly requires a very large proportion of comparatively unskilled labour for the operations of weeding, stripping, and harvesting the cane; this work is at present efficiently done by South Sea Islanders, but might quite as well be done, in the more temperate parts of the colony at least, by white labour, and for the most part, as the work is moderately light, by lads of from fourteen to twenty. The supply of white labour able and willing to work in the canefields is from various causes scarce, expensive, and uncertain; and the cane-growers are therefore driven to employ coloured labour. This, however, is unsatisfactory to the country at large, and not always entirely satisfactory to the growers themselves.

I would suggest, therefore, that an attempt be made to fill the want here indicated, by European and native lads under contract and apprenticeship, on a progressive scale of wages, and under Government regulations and supervision, not only as a means to supply present requirements, but more particularly with a view of training and raising up a body of workmen used to agriculture, who will take up our Crown lands and, in their turn, train others in the same way.

The want of such lads is more or less felt in all branches of farming, but more particularly in those mentioned; and could every farmer have one or more such lads in his employment, it would benefit both agriculture and the country generally.

We cannot, as farmers, offer the high wages and opportunities of amusement which the towns afford, and which seem to have such a powerful attraction to our young people, both native and immigrant; but it is possible to offer them fair and sure wages and the chance to become their own masters.

I would therefore advocate the institution of a system made, if it can be done, sufficiently attractive to draw the peasant youth of our own colonies and of the old country, and would frame it largely on the lines adopted by our own Government in dealing with orphan lads, and place it under the control of the Immigration Department.

The following is the scheme suggested, viz.:—

Farmers requiring lads to make application in Queensland through the Immigration Department.

Engagements to be for four to six years. Minimum age, fourteen years. Wages, sliding scale per week. Passages at assisted rates—viz., £12; to be first paid by the employer or by the Government at his risk, and to be repaid by employee at per week till term expires.

Labourer at termination of agreement to be entitled to a land-order of £50; such order to be non-transferable, and to be used only to assist the holder to settle on the land. It is very important that this should be liberal and worth striving for.

Employer to clothe and feed lads.

Proportion of wages to be paid into savings bank.

Suitable regulations to prevent oppression on part of employer or misconduct on part of employee; to establish a general fund for cases of extreme sickness, death, &c.; and to give lads the opportunity of gaining some sort of scholarship to enable them to enter the Agricultural Colleges.

There are in Great Britain thousands of lads, sons of middle-class and labouring people, who would, I feel sure, be glad to avail themselves of the chance here set forth, and whose parents and guardians would be willing that they should come, provided that they were assured that the lads would get fair treatment and care, and a reasonable opportunity of advancement. Many parents of the middle class do not know what to do with their sons, and many lads of the country labouring classes are, from the depression of home farming, out of work or drifting into the towns, and only want to be shown such opportunities exist to induce them to emigrate. There are also, in addition to the general population, large establishments such as Dr. Barnado's, Muller's, and others which annually turn out large numbers of well-trained lads who would be very useful to us here. It matters little to us whether the lads come from town or country if they are strong, healthy, and willing to work.

Could such a system as the foregoing be successfully established, it would, in all probability, grow rapidly, as the field for recruiting labour is a large one. We should be able to train the young immigrants to the ways of the country, constantly increase the numbers of our farmers and farm labourers, and create a larger and longer demand for our unoccupied lands.

The system might also, in a slightly modified form, be applied to adult labour, and used as a means of giving the adult immigrant the chance of "looking round" before he ventures into farming or other business on his own account. This would be of inestimable benefit to many.

The gist of the whole matter, whether relating to lads or adults, consists in making agriculture sufficiently attractive; and this appears to me can better be done, not by offering high wages which we really cannot afford, but by giving people the opportunity of self-advancement.

The immigration machinery for working the system is already in existence, and beyond its use the Government would only be asked for their fostering care and a liberal extension of the land-order system to those who shall have shown themselves worthy of it by serving a proper apprenticeship to their trade of agriculture.

Mr. J. Lely congratulated Mr. Wells on his paper. Since the stoppage of free immigration to Queensland, there had been a difficulty in obtaining lads for dairying or farming purposes, unless they were home-bred youths. Queensland-bred lads generally took to work that was in some way associated with the horse. This, although unfortunate, was a fact, and he was not going to discuss it. If it was possible to induce strong, healthy lads to come here from England, Scotland, and Ireland, by all means let them come. They would be a great boon to the colony, especially in the North. The average kanaka was useless for doing any work that required intelligence, and consequently the lads referred to would be very useful for such work as gardening,

&c. Every Northern farmer could profitably employ a trustworthy lad about his place, and would be glad to get one. Boys from orphanages and similar institutions were generally too young. Doubtless if they were absolutely certain they would be well treated here, plenty of boys would be glad to come to Queensland from the United Kingdom. Suitable lads could probably be got from Dr. Barnardo. Youthful help was always being wanted in many branches of farming in Queensland, and frequently the native supply of such help was insufficient. Coffee might be given as an example of an industry which especially required this kind of labour.

Mr. William Deacon agreed with the last speaker and Mr. Wells with regard to the value of youths in many branches of farming. Boys about fifteen or sixteen years of age were always handy, particularly in dairying. He had always found Queensland boys well worth their wages, and considered them equal to any boys in any other part of the world. They were useful in anything about the farm, and not solely for work with which horses were connected.

Mr. T. E. Coulson said he had been very pleased to hear the paper, especially after some of the remarks that had been made the previous night about the labour that was necessary for the Northern canefields. Mr. Lely had told them then that such work was not fit for white men, and if people in the United Kingdom were to see that statement it would hardly encourage them to send their sons out to Queensland to do this kind of work. While on this subject, he might say that in his own district (Rosewood), the farmers did all their own work in connection with the cultivation of cane, and without the assistance of any coloured labour. Notwithstanding this, however, they only got 8s. per ton for their cane, while, from what had been said the previous evening, it appeared that the farmers in the North got up to 14s. per ton.

Mr. W. D. Lamb (Yangan) said he did not agree with Mr. Lely's remarks that Queensland boys were only fit for riding horses. He employed about half-a-dozen boys himself and, although not a native, considered that Queensland lads, so far as work was concerned, were equal to any in the world.

Another gentleman endorsed the last speaker's remarks.

Mr. Lely said he had only spoken of the Australian native as he had found him in the North of Queensland. There, the native-born Queenslander would not do agricultural work, so long as he could go away cattle-droving or something similar. He was glad to learn, from what had been said, that such was not the case in the South. With regard to the introduction of lads, he, of course, had not meant they should be employed, in the North, in the hard field work, such as was at present done by kanakas. In the light work, and particularly the work requiring a certain amount of intelligence, they would be chiefly useful.

Mr. Thynne said if the boys that are growing up in the colony were handled in the right way, there would not be much occasion for parents to complain of difficulties in obtaining employment for their sons. In Brisbane, business people were being continually harassed by parents seeking positions for their children. Although many still detained their sons in town in the hope of something turning up, still he was pleased to see there was a greater desire on the part of parents to send their boys to respectable country farms. This tendency would also probably grow and improve, but they must remember it would not be assisted by associating the work of the lads with that performed by the South Sea Islander. There was another point in Mr. Wells' admirable paper upon which he might also sound a note of warning. Some years ago it was proposed to secure a supply of indented labour from certain European States, and, unfortunately, the term "cheap labour" was attached to it. This was at the time when the prohibition of coloured labour was contemplated. When a representative of this colony went to Germany with the indented labour object in view, he was simply scouted out of the country. The people of Germany resented bitterly the proposal that any of their countrymen should be asked to go out to Queensland to take the place of an inferior race. The effect of that visit to-day is, that the idea of emigration to Queensland is most

unpopular and distasteful in Germany. Looking at it from an Australian point of view, it should be noted that it has largely been the experience in America, that the class of people who came out indented for a number of years, did not prove to be the most desirable class for the ultimate settlement of the continent of America. This was doubtless one of the chief reasons why legislation had been passed in America prohibiting the introduction of labour under contract. In the United States it was necessary that every man coming into the country should come in as a free man. These were two of the points of view from which this question of indented labour should be studied.

Mr. J. E. Noakes said a question had been asked on the preceding day, why black labour was employed in cane cultivation in preference to white. The answer was because it was reliable. In the midst of harvesting, when the cane was ready for the mill, and a couple of days' delay might spoil a year's work, the black man was not in the habit of suddenly demanding his wages, or making some similar demand, and threaten that unless it was complied with he would stop work. The same, however, could not be said for the white labourer.

IRRIGATION IN QUEENSLAND AGRICULTURE.

This was a matter which was brought up for general discussion at the request of the Central Queensland Farmers' and Selectors' Association. To open it, Mr. J. Lely said that, so far as he knew, the only district in the North of Queensland where irrigation was carried out was on the Burdekin.* Irrigation without draining was a success there, because the subsoil was very porous and consequently did not require drainage. On the other hand, however, in most soils, irrigation was money simply thrown away unless drainage had been gone in for previously.

Mr. T. Whiteley said that so far as he was concerned, he wanted irrigation in connection with orchard work. For his water supply he would have to sink about 40 feet, and that chiefly through gravel. He would also have to lift it, so that, on the whole, the expense would be considerable. He would therefore be glad to know if Mr. Benson or anyone else would be able o inform him if irrigation under such circumstances would be profitable.

Mr. A. H. Benson said he had had some experience in irrigation in California and New South Wales, but the question was a very big one. In irrigation, the first thing was to get your water, and, unless a plentiful supply of water was always available, it was hardly worth while considering irrigation. The next point was the quality of the water. All water would not do. Many of our artesian waters were too strongly impregnated with alkaline salts for irrigation. Most Queensland river waters were, however, good. Then came the matter of soil, and no soil was suitable for irrigation unless the drainage was perfect. The land from which the best results could be got, was that on which two or three inches deep of water could be placed and then twenty-four hours after could carry a horse safely over it. Irrigation, however, was useless on land with a shallow soil, especially in orchards, as the water would kill everything. The next question was the cost of the water. The cheapest water was artesian water, for the reason that it is raised to the surface, from which it can be distributed all over the land without lifting. The next cheapest water was that from rivers or lagoons, where the lift required was only slight, say up to 30 feet, and which could be done by means of centrifugal pumps. On a small scale irrigation can be done with small pumps and windmills; and in some parts of California, where irrigation is carried on to a great extent, windmills are very largely used. In California irrigation is chiefly used in connection with the growth of fruits, vegetables, and lucerne. Having secured the foregoing necessary conditions, there were minor

* The best scheme of irrigation in Queensland is carried out on the Pioneer Plantation on the Burdekin, where water is obtained in quantity at a shallow depth and is distributed by pipes over the land. Irrigation on a small scale is also carried out with marked good effect at "The Palms," Mackay.—Ed. *Q.A.J.*

matters to be considered. It was no use trying to irrigate hillsides. The expense of maintaining the channels, &c., was so great that it was not repaid by the results. Let them imagine an attempt to irrigate a hillside. The head ditch has to be brought to the top of the orchard, and then contour lines have to be taken across it. Each tree has to be ringed—that is, a circular ditch put round it—and this was not satisfactory, as it confines the roots of the trees to one portion of the land. Taking also into consideration the extra difficulty of keeping up the ditches on hillsides, it would be seen that the soils most suitable for irrigation were those that were level, or with only sufficient fall to get rid of the superfluous water. Irrigation was useful for fruit trees and also for growing cane or corn in the dry districts of the colony. It was very desirable that our stock-raisers and farmers should be in a position in the future to produce fodder sufficient to allow of some being carried over for dry seasons, and he believed that, with our artesian water supplies, it was possible to produce in the deep sandy loams of the West of Queensland, first-class crops of corn, lucerne, &c., which it is extremely difficult to do in the natural state of the land. These crops could be saved until such times as they were required, and with this reserve supply of fodder, the squatter, in times of great scarcity of feed, would always be able to save the best of his stock. The best way to apply water to land that was level, and which was intended for such crops as corn, sorghum, cane, or fruit trees, was by means of furrows drawn by a plough. A plough in this case is preferable to a Planet junr. cultivator. Turn the water into the furrows from the head channels, but only let it travel along the furrows just as fast as the soil can take it up. A rush of water is not necessary, and if it is found that the water is travelling too fast, a man should stop it by throwing up checks in the furrows. The water, of course, should be led all over the field. There were other matters in irrigation which had to be watched, even on the most suitable land. In very hot weather, if water was poured on to the surface of the ground during the time the sun is at its strongest, and the water came in contact with the roots of trees or plants on the land, it would in all probability seriously injure them. Night, naturally, was the best time to apply the water. Again, the best results were got by irrigation and cultivation combined. As soon as the land would carry a horse and cultivator after the application of the water, the Planet junr. cultivator or some other similar implement should be called into requisition, and the breaking up of the furrows proceeded with. When the water had been put on the land, the next step was to keep it there, and this was accomplished by a thorough system of cultivation, stirring the soil but not turning it. Another point was the necessity of taking care that the watering did not produce a "pan" in the soil. At Mildura it had been found, and also at other places, that after land had been constantly irrigated a "hard pan" formed in the soil at a distance of from 1 foot to 8 or 10 inches from the surface. If this was allowed to remain, the water got down as far as this pan, stopped there, and turned sour, with the result that all plant growth was stopped. It was therefore necessary to have a subsoil attachment to the plough used in working such land, in order that the pan could be broken up.

In addition to irrigating by means of furrows, there is another method of irrigation that is frequently used in connection with the cultivation of lucerne, but it is only of value on level, or nearly level, country that has a deep free loam or sandy loamy soil. This is irrigating by means of checks, which is carried out as follows:—First, the land is levelled as evenly as possible with a grader; it is then cut up into blocks of any desired size, but the fall in the land in any one block should not exceed 6 inches. Checks or mounds of earth are next thrown up round each block with the grader, the water being brought on to each block by means of a head ditch running at the highest side of each. The water is turned on to each block in turn, and is allowed to run till the whole block is flooded and the lucerne has received a thorough soaking, when it is turned on to the next block. The levelling of the ground and the formation of the checks is not at all a difficult matter, all that is required being a good steady

horse, a man with a good eye, and a grader which is made of a piece of hardwood 2 inches thick, 1 foot wide, and about 6 feet long, and bevelled to an edge on one side. Two ends and a handle are then attached, and a couple of eyed-bolts are screwed or bolted on it, to which the draught chains of the horse are attached. Lucerne should be irrigated as soon as the crop is taken off, and should be harrowed as soon after irrigating as it will carry the horses so as to prevent the surface baking. Lucerne should be planted in drills to be irrigated and harrowed in this manner.

Mr. WHITELEY thanked Mr. Benson for his information, and stated that it had made such an impression on him that he had decided not to invest in any irrigation plant.

Mr. J. H. MCCONNELL said it was difficult to get level land on alluvial flats for lucerne. In lots of cases in Queensland the system described by Mr. Benson would be too expensive. A system he had seen adopted was, distributing the water by means of calico hosing after the water had been lifted by means of centrifugal pumps. The hosing was very inexpensive—costing about 3d. per yard—and was procured in lengths of about ten feet. The lengths were joined together until a pipe, say, a quarter of a mile long was made. The water could then be carried by means of this pipe all over a lucerne or other paddock. Stock put on to irrigated lucerne land was very apt to cause the surface to cake, which of course should be avoided.

Mr. LELY said the people on the Burdekin found the disc harrow the best thing with which to break up the land after irrigation.

Professor SHELTON mentioned that Messrs. Sealy and Malcolm, of Harrisville, had put in 100 acres of lucerne with irrigation, and had been singularly successful with it. The system of irrigation by means of hose-piping, referred to by Mr. McConnell, so far as he knew, appeared to be peculiar to Queensland, but it was a very satisfactory method, notwithstanding. A great difficulty in connection with irrigation in Queensland was, that after a man had got an irrigation plant, he would find that he did not require it. This was the experience of many. In all countries where irrigation was systematically adopted the people had an arid climate. In Colorado, where he had gained his own irrigation experience, the annual rainfall was only about 10 inches. In such a country irrigation was absolutely necessary, but in Queensland the case was different In most years they had plenty of rain, and it was only in times of drought like the present, that people felt the pinch of necessity, and began to talk of irrigation. It had been said that ditching was absolutely necessary to the success of irrigation, but drainage ditching was a question that should be considered by itself. As Mr. Watt had already pointed out, drainage was always helpful to land, but this did not prove that drainage was essential to irrigation. In Colorado he had known hundreds of cases where irrigation was successful, and where under-drainage was never thought of. No doubt under-draining would be beneficial, but in Colorado, if the original settlers had thought that under-draining was a necessity, they would probably have abandoned the country. Drainage was good with irrigation and without it, but irrigation was often good upon land that was not under-drained.

In reply to a question, Mr. MCCONNELL said the pump he had previously referred to was simply a centrifugal pump. He gave an instance bearing out Professor Shelton's remarks about the irregular necessity for irrigation in Queensland. He knew a gentleman who purchased an extensive plant, kept it for two years without once using it, and then sold it. Immediately after the sale the drought set in.

Mr. THOMAS ARMSTRONG instanced the case of a farmer who had invested £300 in an irrigation plant. He was now being repaid for his outlay during the present dry season.

Mr. J. LELY pointed out the difference between tropical and Southern Queensland in respect to irrigation. In the North, under-draining was a necessity, because, if the land was allowed to remain saturated with water, the young cane plants would quickly perish.

In reply to a question of Mr. Armstrong's, it was stated that a farmer had tried irrigation at Oxley with brackish water from the Brisbane River, and had been very successful in dry seasons. It had also been tried on the Pine River on a small scale, and although it had not been a very great success there —the lucerne plants dying out—this was doubtless due to the land not being under-drained or through the subsoil not being stirred.

Mr. W. Soutter reminded those present that though irrigation benefited the land, still it took away a lot of nutriment matter from the soil, and manure should follow all applications of water to land.

Mr. A. H. Benson said he did not wish to infer that, although beneficial, irrigation was a necessity. In nine cases out of ten in Queensland, probably better results would be secured from deep cultivation. Where irrigation would tell was in the dry, arid interior, where small rainfalls were the rule. Plenty of care, however, and deep cultivation could withstand most droughts. At the Wagga Experiment Station in New South Wales, he had been instrumental in growing crops during the hottest and driest of seasons, simply by keeping the land well stirred and cultivated. The more land was stirred in dry weather, the more moisture was kept in it, and in the coastal districts this should be ample for keeping all fruit trees alive. In the interior irrigation would be useful, but here, the matter of whether the water was suitable or not, came in. He endorsed Mr. Soutter's remarks about the necessity of manuring land after irrigation.

A delegate instanced a case of two Brisbane gentlemen who had tried irrigation, but with only partial success. Farmers in the same districts were getting better results from deep cultivation.

SIXTH SESSION.

Friday Evening, 11th June, 1897, at 8 p.m.

Mr. William Deacon, of Allora, read the following paper on

THE CULTIVATION OF WHEAT AND BARLEY.

Wheat-growing in a colony may not make such rapid progress, nor attain such a high position, as the growing of some other products, yet it is of supreme importance. A country should, as much as possible, produce for its own people the bare necessaries of life, and for its own safety not depend upon other countries for those necessaries. For a highly civilised people, wheaten products and wheaten bread and wheaten produce are a first necessity. How stands it with Queensland in this matter? The population is, say, 450,000, and, reckoning 8 bushels to each individual, our needs are in round numbers 3,600,000 bushels. In 1895 we produced 125,000 bushels, and in 1896 about 500,000 bushels; and this, had the season been favourable for sowing, would, on account of the prospect of a considerably enhanced price, have been greatly enlarged—to the extent of at least 80,000 bushels. It is evident, provided Queensland wheat can reach the Queensland consumer, that it will be some time before there will be a surplus for export.

Wheat-growing in Queensland may be said to be an old industry. Wheat was grown before separation by Mr. Evans, of Toolburra, near Warwick. He is credited with being one of the first, if not the first wheat-grower in Queensland. A flour-mill on the then most modern type, was erected in Warwick early in the sixties by Mr. C. Clark, who, in one season, if not more, paid 10s. per bushel for grain.

Wheat grown in the Warwick district by J. Mitchell was exhibited at the Paris Exhibition in 1867, and was highly commended. For a long time in the colony there was an unaccountable prejudice against Queensland-made flour. Mr. Kates, who established a mill at Allora early in the seventies, was one of the first to break it down by producing flour of a very superior quality, and now Queensland flour is acknowledged to be equal to anything produced in any of the colonies.

The principal kind of wheat grown for many years was what is called the White Lammas; then followed the Purple Straws, Defiance, and others. Many of them were very subject to rust, others were swept out of existence by that disease, and all more or less became deteriorated. Here is where the value of the experimental or, say, stud farm will come in for the wheat-grower. The stud farm or plot is as necessary to the farmer as the stud flock is to the grazier; and for the want of it, worn-out, run-out sorts and seeds, that will neither resist rust nor drought, and run to complete waste with excessive moisture, have been cultivated to the ruin of the farmer. Accident provided the Downs, however, with a wheat just in the nick of time, which is mainly responsible for the increased area under that cereal in Queensland, and which is now in high favour in the other colonies. I refer to the sort known as the Allora Spring Wheat. This was first grown from a couple of ounces of grain obtained by the *Queenslander* from Mr. Farra, the eminent and enthusiastic New South Wales wheat-grower and experimentalist, and then sent to Mr. J. Kelly, of Allora, who grew and distributed it. It is a grand, quick-growing spring wheat, and appears to suit both wet and dry seasons. It is not rust-proof, but it mostly eludes the rust by maturing early. It is a fair but not heavy yielder; its greatest fault is that of shelling too easily in a showery harvest. Care should be taken of it, lest it become deteriorated and go the way of its predecessors, but there are no signs of this at present. It is a wheat eminently suited to the colony, and, I believe, will grow in almost any part of it.

The Agricultural Department has experimented on wheat, but under exceptional difficulties; but it has some grand wheats, as I know from my own observation—wheats which I am sure are suited to the colony—heavy yielders, and which will be heard of yet: notably amongst them Venning's Rust Proof, Grose's Prolific, and Mexican Spring, and many of Farrar's and Marshall's. There is a great opening for the Agricultural Department in their agricultural experimental farms, which I may be pardoned for saying I hope will be numerous and small, rather than few, large, and expensive. One hopes, in trying to look ahead for the future of farming pure and simple, to see the same progress made in the field as has been made in the fruit and flower garden, and to see the same improvement made in our cereals and fodders as has been effected in our flocks and herds.

Wheat is sown on the Downs from the last week in April to the beginning of August, on land which has generally been ploughed twice, or on once ploughed corn land. Early sowing is not only the safest—by catching an early rain—but no doubt, as a rule, the yield is much heavier, and it has a better chance of escaping the rust should it be a year for it. Last year, however, the best crops were from late sowing—July and up to 4th August. Sowing is generally by what is termed broadcast by hand on the sods, which are then twice harrowed at least. But the drills, of which there are now several excellent ones of different make in Queensland, are now coming into favour. By drilling, no seed is wasted, the crops are more even, and on an average the yield is heavier. The seed-bed can also be well prepared beforehand, the seed is put down at an even depth, and as a rule less rain will start it growing.

I do not propose to deal with the harvesting of wheat, except to say that it is best cut when the grain is in the dough stage; nor, except with regard to smut, with its diseases. For smut, the majority of wheat-growers, as a preventive, dress their seed with bluestone—sulphate of copper—¼-lb. to the bushel. More might be dangerous, and I have seen less effective. One pound of bluestone is powdered and dissolved in a quart of boiling water; to this is added three or four gallons of cold water; and you have sufficient to dress one bag of seed, which is done in various ways, all explained, I believe, by the bulletins issued by the Department. With regard to rust, at present I will leave that to the scientific man, or for general discussion. The best thing to do is to sow wheat that will get out of the way of the disease before it becomes virulent. With us, if we have wheat that is behind hand and not out of danger by the end of

the second week in November in an ordinary season—as a rule—we shall possibly find that we are out of it. I believe there are some really rust-proof wheats; the worst of it is, however, the miller cannot look at them. One might say that some of them are a sort of a cross between barley and some hard material. They are like Mark Twain's hog-proof potato—when the pigs passed it, everybody else did; and although it made excellent road metal, it was found worthless for any other purpose.

Now, I will say a few words about wheat distribution. It is a singular thing, but though the production of wheat is very far below the colony's requirements, farmers have sometimes, if not often, a difficulty in disposing of their crops at fair market rates. There are various reasons for this. In the first place, millers are few, and competition is reduced to a minimum, and I am afraid it is a fact which cannot be denied that often, if not generally, an arrangement is made between the majority of the millers as to what price they shall give for wheat, and any miller standing out is bound to follow suit. As this price is often below what, considering the relative price of flour-wheat is worth, the farmer refuses to sell. Another cause for the difficulty of selling wheat is, that as a rule, in Queensland, all the crop is put upon the market or attempted to be put on the market within a month or two or, say, within three months. There is another difficulty affecting wheat distribution connected with the railways, which I understand is to be brought up in another form, and which, therefore, I shall not touch. With regard to the first difficulty, it has been proposed to establish central mills for the wheat farmers in the same manner and, I presume, on the same conditions as the central mills for the sugar-grower. I am loth to give an opinion. I would prefer to encourage, by bonus or through the Customs, the establishment of more flour-mills by private or joint stock enterprise. Flour-milling must be one of the most profitable occupations in the colony, and it is a wonder that men having a decent capital and seeking to make it more, or to turn it into a fortune, do not enter upon the business. I hope, too, the time is not far distant when individuals who now invest their savings in Wild Cat Mines in various places, or in Melbourne Sweeps, will promote companies and invest in this and other paying industries, and thus assist to assure an undoubted prosperity to the colony.

The subject of barley-growing is also set down to me. Certainly I have grown barley off and on for the last seven years, still I would not like to pronounce an opinion upon it. I mean malting barley. I hope some members of the Conference will discuss it. My experience is that it takes longer to develop than spring wheat, and therefore should be sown early. I know it yields as well, if not better, that it is less liable to rust, and that often there is a good demand for it—a demand which is likely to increase year by year. When it should be cut I should like to know—when dead ripe and swan-necked, as in the old country; or in the dough stage, as experience has taught us we should cut wheat? It is a beautiful crop to grow in any case:

> For the free and happy barley
> Is the monarch of them all.

Professor SHELTON pointed out that the Allora spring wheat had originally come from California. Otherwise Mr. Deacon's history of this variety had been perfectly accurate.

Mr. DEACON stated that he thought it was a Minnesota wheat.

Mr. MOULDAY considered wheat a profitable crop to grow, when the price was 4s. a bushel or over. This year they had got a good price for their wheat, but last year they had got practically nothing, while the year before that they had got a good crop, but no price. A difficulty with spring wheat was that it was very hard to harvest in wet weather.

Mr. W. D. LAMB (Yangan) concurred with Mr. Deacon in his remarks about Allora spring wheat. However, there were other varieties coming into favour in Queensland, and among these was the Belatourka. This latter variety would withstand wet weather, and, although originally disliked by millers, it now fetched a good price. Budd's Early was another promising

variety on the Downs. With regard to harvesting wheat, &c., he might say that since the Department of Agriculture instituted inquiries some years ago, relative to the cost of the production of wheat, the cost had been cheapened considerably. This had been largely done by the introduction of new and improved machinery to reap and thresh the wheat, and the increased competition among the owners of reaping and threshing plants. Most of the Downs wheat-growers were now using threshing machinery, and this did away with many expenses in connection with horses and bullocks, and generally the industry was now on a better footing than it had ever before been in the colony. There was certainly a great future for wheat-growing in Queensland. Barley had been tried in the colony, but the cultivation of it had lapsed for want of a market. It was now coming somewhat into favour again, but at present prices he thought wheat a more profitable crop. As regarded harvesting barley, his experience had been that it should be allowed to get dead ripe, if it was required to make a perfect malt. The seed would always germinate better when it was thoroughly ripe.

In reply to Mr. Coulson, Mr. Deacon said Allora Spring was a white and plump wheat. If cut rather green it had a rich yellow colour, and was perhaps heavier than when cut fully ripe. In the latter case, however, the colour was white. An advantage in Allora Spring was, that in rust seasons, when the grain of other varieties got pinched to the size of carraway seeds, although small, it was otherwise perfect. To those who had difficulty in procuring Allora Spring seed true to name, he suggested that they ask the Agricultural Department to assist them.

Mr. W. D. Lamb said Allora Spring would assume different colours and shapes according to the time it was reaped, but naturally it was a round, plump grain, and should certainly not be elongated.

In reply to Mr. Lely, Professor Shelton said he had about thirty varieties of Egyptian wheats ready on the farm, waiting for an opportunity to sow them. They were very hardy wheats, but, as millers would not buy them, they were only good for chicken feed.

Mr. T. W. Caswell (Wallumbilla) mentioned the case of a neighbour who had planted Allora Spring alongside a paddock of Ward's Prolific, and when they were grown no difference could be seen between the wheat in the two paddocks. He had himself found the Talavera an excellent wheat for the Maranoa district, and Ward's Prolific was also a good rust-resisting and otherwise satisfactory variety. When he first tried wheat in the Maranoa district, it was very subject to smut, but about five years ago Professor Shelton had advised him to dress the seed wheat with salt water and then dry it with a little lime. He had followed that practice ever since, during which time he had never been troubled with smut. A neighbour of his had dressed his seed with bluestone on one or two occasions, but it had not prevented smut, and he therefore thought the salt water was a preferable dressing for the seed.

Mr. Deacon stated that the Allora Spring was a totally different variety from the Ward's Prolific. With regard to treating wheat for smut, he preferred bluestone, although salt and water was also a good dressing. The latter, however, was not much used now.

In reply to Mr. J. B. Stephens, Professor Shelton said that in his opinion the country about Gayndah was undoubtedly a wheat country, and there was ample evidence for the opinion. The wheats most suited to the Downs would also doubtless flourish about Gayndah. With regard to the Allora Spring wheat, it most certainly deserved the many commendations that had been passed upon it. It was hardy, rust-resistant, and fulfilled a long-felt want in Queensland. However, it was open to some objections, and the most important of these was its inferior quality. It was deficient in gluten. Millers complained of and bakers strove to reject it. Of course, this difficulty might be got over by judicious blending with other varieties. Its great fault was that flour made from it did not rise properly, and this was a universal

complaint against it. Ninety per cent. of the wheat grown in Queensland to-day was of this particular sort, so that millers were largely unable to make a proper blending. If farmers would grow Defiance, Town and Country, or African wheats, then, by blending them with Allora Spring, a perfect flour could be obtained, and this would probably also meet the wants of the farmer. At present, the repute of Queensland flour was jeopardised by this Allora Spring wheat, which was simply a ball of starch, and wheat was not grown to produce starch. It could be obtained more easily from other plants, such as the sweet potato. Then as regards the Belatourka. This undoubtedly was a very hardy wheat, and it had the great advantage of passing through rainy seasons uninjured. In 1894 those farmers who grew Belatourka received excellent crops. This variety has a long straw and a drooping head, with the result that rain runs off it without trouble. However, the moment they undertook to sell Belatourka millers were up in arms against it, and naturally. It belongs to a different class of wheat to the Allora Spring, and its gluten did not have sufficient elasticity. A loaf made from its flour did not rise properly, and the bread had always a golden tint. Personally he did not think the tint an objection to the wheat, but such was the case. However, there were other wheats coming into vogue now in Queensland, and these would probably ultimately take the place of the Allora Spring, Belatourka, and others now grown here, Amongst them were varieties which he thought would prove superior in quality to them, and at the same time be their equal in yielding and rust-resistant powers. He had now been carefully testing varieties for over four years, but, just when he was on the point of bringing his experiments to a practical issue, two successive seasons were experienced in which he hardly got a return for his seed. At the present moment, he had 500 varieties waiting the arrival of wet weather to be planted in.

Wheat was a most valuable hay crop, and in such seasons of drought as the present farmers would find it superior to oats for this purpose. It endured dry weather better than oats; and although the latter were preferred by many for hay in a dry season, the wheat would always give a much better return. Most of the varieties, however, at present grown in the colony were not hay wheats. The Allora Spring was not a good sort for hay, it being a poor yielder in this respect. The Purple Straws might be grown for hay; but they should not be grown for grain. Talavera and Lammas were good hay wheats; but the Belatourka was, perhaps, too tough for this purpose. The best of all, however, for hay were the Scotch wheats, such as the Fifes. With regard to dressing seed-wheat for smut, bluestone, of course, was an old remedy; but modern experience showed there were several other dressings quite as valuable. The best of all was hot water, and he thought, if farmers once tried it, they would permanently adopt it. Bluestone, if given in too large a dose, injured the wheat; but hot water, on the other hand, had the additional advantage of seeming to give the wheat treated a stimulus. In fact, it had been shown by experiments that wheat treated with hot water gave a more vigorous growth than that treated with other dressings. Seed can be very easily and expeditiously treated by placing it in perforated kerosene tins, and dipping these into caldrons containing water heated to a temperature of about 135 degrees Fahr. This would kill smut, but not rust. No treatment of the seed has ever yet been discovered that would prevent rust.

Mr. W. D. Lamb (Yangan) pointed out that although Brisbane millers appeared to dislike Allora Spring, yet flour manufactured on the Downs, and which was very largely made from this particular variety, was able to successfully compete in Brisbane against the local article, chiefly made from imported wheat. He believed, however, in blending some of the hard varieties with the Allora Spring.

Mr. M. O'Keefe said he was glad Professor Shelton had raised the question of fodder in connection with wheat. Many farmers thought wheat improved the land, and many in his district (the Lockyer) would be glad of information on this point. The opposition that had been made in the past to

Downs flour, was doubtless largely due to prejudice. With many people the idea unfortunately prevailed, that a local article must necessarily be inferior to the imported.

Mr. DEACON said he would like to add a word about barley. Although they did not get so big a price for it as for wheat, yet they got a larger crop. With regard to a market, there seemed to be a probability of some more malt-houses going up in Queensland, but in any event, if the Victorians took off their duty of 2s. a bushel, plenty of barley would be grown in this colony. With regard to the heavy crop of wheat of a couple of seasons ago, he said he might here record the gratitude of the Downs farmers to Maryborough, for relieving the local markets of what would probably have otherwise been an inevitable glut in wheat. At that time Maryborough absorbed a very large quantity of Downs wheat. For hay, he thought Defiance and Town and Country were among the best varieties of wheat to grow in Queensland. He thought Professor Shelton had perhaps been too severe on the Allora Spring. It was a very easy wheat to grow, and was just the kind for a dry season. With regard to its milling qualities, a large Brisbane biscuit manufacturer had told him Allora Spring flour was one of the best sorts for him. Personally he had never eaten better bread than that made from the same flour, but, however, he thought the milling qualities, of the Allora Spring were improving, and one reason for this was because it was cut earlier. Still millers always grumbled about a new variety. He remembered when Defiance was first introduced, it only fetched a little over two-thirds the price obtained for other varieties. Two years afterwards, he could get 3d. per bushel more for Defiance than for any other sort.

Mr. T. E. COULSON (Rosewood) gave a few instances showing that the objection to Downs flour was simply the result of prejudice. Barley, he thought, could be successfully grown in the colony, but it was a thing that required expensive machinery. With regard to a market, he mentioned that Messrs. Robert Harper and Co., of Brisbane, were willing to purchase good malting barley.

Mr. THYNNE said he had been informed by an expert, that the Downs could produce malting barley equal to any in the world. It had less waste and more useful material in it than the majority of such barleys. He also had it from the same reliable authority, that there was a ready market in the colony for four times the quantity of barley that was raised in Queensland last season. A considerable amount of barley was annually imported from New Zealand, and, in short, he did not think there was any likelihood of there being a short market for this crop. There was one point which had struck him in Mr. Moulday's remarks, and that was, his estimate at what price wheat was profitable. Of course it was difficult to make an estimate, but if they were ever going to look forward to exporting wheat, they would probably have to produce at a somewhat lower figure than that mentioned by Mr. Moulday. He believed in Canada and in the States, where such enormous quantities of wheat were grown, it was produced profitably when the price was below Mr. Moulday's 4s. Doubtless, when their farmers reached out further than the Downs, wheat would be produced cheaper and in much larger quantities than it was at present. With regard to Mr. Deacon's remark about the practical prohibition of the importation of Queensland barley into Victoria by the 2s. a bushel duty, he might say that probably there was going to be a change in this respect, and, instead of barley being sent from Queensland to Victoria, they would not unlikely have Victorians sending this article to Queensland, there to compete with barley from all parts of the world.

RECOMMENDATIONS COMMITTEE.

THE proposed resolutions of this committee were then dealt with. The first was :—"That this Conference supports the recommendation recently made in England to the Imperial authorities by Mr. Jager and others in reference to the advisability of admitting tea, coffee, and cocoa into Great Britain free, and the imposition on foreign beet sugar of a duty equivalent to the amount of

revenue now obtained from the tax on tea, coffee, and cocoa; and that this Conference is of opinion that such a course of action on the part of the Home Government would be a distinct gain to Queensland and the other tropical and sub-tropical colonies, and a step towards Imperial federation; and it would therefore recommend that this motion be cabled by our Government to Sir Hugh Nelson, to be placed before Mr. Chamberlain."

In support of the recommendation, Mr. LELY stated that he had been instructed to bring the matter up before the Conference, and pointed out that tea, coffee, and cocoa were products which chiefly came from British colonies. A fact of a most startling character had been made known to him illustrative of the fearful competition which beet was offering to cane sugar, and the pressure of this competition now experienced by West Indian planters will very shortly be felt by Queensland cane-growers. A planter in British Guiana was asked by a reporter of the *Financial News* whether it was not owing to the antiquated state of his machinery that he was unable to compete with beet sugar. In reply, the planter stated he had spent £250,000 in improvements, and had employed a French chemist at £2,000 a year to superintend his operations. This chemist went back to France, and his former employer meeting him asked him how much it cost him to produce a ton of sugar. The chemist said £14 per ton, and although it only sold for £12 in the London market, yet they still made £2 per ton clear profit on it. This was, of course, due to the £4 per ton bounty. The present was an excellent opportunity to pass such a resolution as that proposed. It was a British suggestion, and one that was made by Mr. Jager, a leading English financier. It had also been supported by a committee that had lately been gathering information on the sugar question in the West Indies. The West Indian Sugar Commission, of which Sir Henry Norman was chairman, had also gone into the matter, but he had not yet heard what had been their opinion on it. He stated, however, that the London *Times* supported the idea.

Mr. E. SWAYNE (Mackay) said the bounty question was undoubtedly the most burning one in the sugar world at the present. There was no product that had to meet such unfair competition as cane sugar. Beet sugar was produced at a loss, and yet realised a profit to the manufacturer. The suggested remedy was that a counter duty should be put upon all bounty-fed sugar, and it had been said that ¼d. per lb. would be sufficient for this purpose. He would like to see the Conference support the motion.

Mr. THYNNE mentioned that at the Ottawa Conference which he had attended in 1894 the Canadian people were very anxious indeed to have a system of preferential rights between all British possessions introduced, so that British products from the colonies would have a preference or privileges in English markets, which were not allowed to similar productions from foreign countries. A long debate and serious discussion took place on the proposal. At the time, he personally did not see how the proposition could result in anything practical, and he had declined to commit himself in any shape or form. A great difficulty which presented itself in this proposal to impose a duty in England on foreign beet sugar, was, that Great Britain was committed to treaties with certain Continental States not to put them in an unequal position, as regards trade, &c., with other countries, including the colonies. He did not think the importance of the fact of the existence of these treaties had been fully realised by those, both in England and here, who were trying to deal with this question. As far as he was himself concerned, his own natural caution would prevent him from committing himself to any resolution without first going deeply into the matter. Again, one name, however influential, was hardly sufficient to substantiate any doctrine on financial questions. The resolution dealt with a very difficult point in fiscal economy, and his own idea was that the matter should be allowed to stand over. To the Sugar Commission, of which Sir Henry Norman was the chairman, had been deputed the very difficult and responsible work of investigating the whole of the conditions of sugar-growing in the West Indies; and he might add that he

thought they in Queensland could take it as a compliment that their late Governor and present Agent-General had been chosen to take such a prominent part in such an investigation. In view of this commission, it would probably be most judicious for them to wait and see what its final recommendations and suggestions really were. They would then have facts and figures on which they could thoroughly rely. Next year he hoped that another Farmers' Conference would be held, and then their friends from the sugar districts would be perfectly right in bringing forward such a resolution as the one proposed, but at present he thought they hardly had enough information at their command to justify them in passing it now.

Mr. J. B. Stephens (Pialba) endorsed the Chairman's remarks. The present Conference could hardly be said to thoroughly represent the sugar industry, and in other respects it would not be altogether wise for them to push themselves forward in this matter.

Mr. William Deacon (Allora) said he would like to see something done in the matter. He sympathised a good deal with the object of the resolution, because the sugar-growers in the British colonies were fighting a most insidious attempt at monopoly. The effect of the bounties in Continental Europe was not to assist beet sugar, but simply to crush the cane sugar. Jamaica was already almost practically ruined, but there was a feeling in England that something should be done for the colonies, and that Great Britain should not assist foreign countries to help to crush colonial industries. The only objection to the proposal was that it interfered with the internal affairs of the United Kingdom.

Mr. J. Lely said there was nothing of a dictatorial character in the resolution. It simply said, the Conference supported a suggestion that had been made in England. The hands of such men as Lord Salisbury and Mr. Chamberlain were not likely to be forced, and he, of course, knew they would use their own judgment in their dealings with foreign countries; but while the statesmen of England openly and boldly talked of an Imperial Zollverein, and while the British Government were trying to encourage colonial enterprises, it seemed somewhat like throwing cold water on this tendency when they refused to assist a project which was being instituted for their benefit. In the meantime the West Indian sugar-planters were being ruined, and although they in Queensland—thanks to the Colonial Sugar Refining Company—had a protected market, the question was one that was ultimately bound to force itself upon them. If the present Conference passed the resolution, it would show those in England interested in colonial expansion, that Queensland was interested in the movement in question. Sir Hugh Nelson was at present in England, and he had been informed the matter would be brought before this Conference. The present was, therefore, an opportune time to pass the resolution, and, moreover, time would be gained by taking action now.

Mr. J. E. Noakes (Wide Bay) said he sympathised with what Mr. Thynne had said. They were asking Great Britain to take off a duty on some articles and place it on another. This, he thought, interfered with the internal affairs of Great Britain. They might ask that country, however, to impose a duty on bounty-fed beet sugar.

Mr. J. V. Chataway, M.L.A., contributed several valuable and interesting details relative to what had already been done in England and the West Indies in connection with this sugar bounty question.

Mr. William Deacon then proposed, and Mr. Moulday seconded, that the discussion be postponed until the following day; but Mr. Stuckey suggested that it would be as well to thrash the matter out that evening.

Mr. E. Swayne (Mackay) said he was rather inclined to agree with Mr. Thynne in the matter. A commission had been appointed to investigate it, and he thought it would be as well to wait for more information before endorsing any particular line of action. It was quite possible the commission would be able to discover some better way out of the difficulty than the one proposed.

Mr. Lely then suggested that it would perhaps be best to pass a resolution expressing their sympathy with the movement in England to counteract the effect of the sugar bounties. He really thought they should not let the present opportunity escape without expressing their appreciation of the efforts that were being made in their behalf.

Mr. W. Soutter (Queensland Acclimatisation Society) said that he admitted the cane-sugar industry was suffering from an unfair competition from the bounty-assisted beet sugar, but, considering there was a commission going thoroughly into the matter, it would hardly be wise for them to endorse any particular line of action. Moreover, Mr. Lely could hardly claim to represent the whole sugar industry of Queensland, and the planters could doubtless be trusted to look after their own interests in this connection.

Another gentleman then expressed the opinion that the Conference was representative enough to be justified in passing a resolution in connection with the sugar industry, but still for all that it would be as well to send back the resolution to the committee. This course was then adopted on the motion of Mr. Noakes.

The next resolution was :—" That this Conference recommends that all the associations here represented direct their attention to the question of the better distribution of produce, especially grain, and report to the Agricultural Department the result of their deliberations. Also, that this Conference recommends to all local associations, and combinations of associations, the increasing need of co-operation, especially as to the direct importation of improved agricultural machinery, and the importance of using well-bred sires in stock-breeding, particularly in dairy herds."

Mr. James Wilson supported the resolution, and in connection with it, read a paper which he had prepared on the subject of railway freights on wheat.

On the motion of Mr. T. Whiteley, seconded by Mr. T. W. Caswell, the resolution was carried.

On the motion of Mr. Whiteley, seconded by Mr. Lely, the following was also adopted:—" That this Conference recommend the passing of a Drainage Act for allowing reasonable rights to owners and occupiers of land for taking away their surplus water through adjoining properties, and also invite the various associations here represented, to consider the question of extensive drainage on similar lines to those of the Scottish Drainage Act, with the view of approaching the Agricultural Department for the purpose of obtaining State assistance for the execution of such work."

In connection with this resolution, Mr. E. Swayne read the following letters which he, as secretary of the Pioneer River Farmers' Association, had received from Messrs. Gibson and Howes, of Bundaberg, some months ago :—

Bundaberg, 27th January, 1897.

Dear Sir,—I have your letter inquiring as to the advantages of drainage on the Bingera lands, and what is the difference between the drained and undrained as to quantity of cane from each.

I also note your reason for inquiry, in which I quite agree. The undertaking would be rather heavy for men with limited means. The cost to us per acre was £5—digging drains, pipe-laying, &c. You may do it for a little less in Mackay, as your subsoil is not quite so hard as our volcanic soil at 2 feet 6 inches depth.

I may state that on Bingera we have now about 1,000 acres drained, and we were encouraged to enter into such expenditure by the results obtained during the 1894 season. In that year there was a fair rainfall, and so satisfied were we with the returns from the drained land over the undrained in the extra quantity of cane and the extra purity of juice in the cane, giving such excellent results in the mill when compared with undrained land, that we determined to drain the whole estate, and with that object in view have held on to our drainage scheme until November of last year.

Then we had to stop and ask ourselves the question, How much further should we go with this heavy expenditure?

The reason which brought us to this point was the fact that rain did not come to give sufficient moisture to reach our drainage system; so that the facts were, land which was not drained, gave nearly as good results as the drained land. This statement applies to 1895-6.

Only in February of last year did we see water in the drains for a whole year, and only twice or three times in two years were the drains called upon to do duty.

I may state that after a dry time, it will require 3 inches of rain to reach the drain-pipes, say, at a depth of 2 feet 6 inches. We have arrived at the conclusion that the cost is too heavy for past results.

You must have a fair average rainfall to help the cane along; indeed, sufficient to reach the pipes, they carrying off the surplus water. Then you will see results which would justify the cost of drainage—in the larger quantity of cane to the grower, with much less cost to keep the land clean; also higher percentage of sugar in the cane, so much so that the factory would soon increase the price paid for cane to the farmer.

But, seeing that we have no power to bring the rain just to suit our needs, Providence has supplied us with abundance of water in the bowels of the earth and in many of our rivers, and this should be secured.

When a system of irrigation shall have been introduced, just on the same principle which you now advocate, you may take my word for it our agricultural system will never be the success it should until drainage and irrigation go hand in hand. Then we may expect the full advantage of any manures that may be put into the land—best results when planting, from the sets springing away at once; hence less need to fill failures in plants, and so an even crop.

All this can be arrived at by means of irrigation when the usual rainfall fails. I wish I could have given you better news respecting our drainage, but we have no fear but that rain will come in plenty again. Then the drains will be all there to do the work of removing surplus water, and so allow the crops to give best results with the smallest minimum of cost.

I am, dear sir, yours truly,

ANGUS GIBSON.

(Gibson and Howes.)

The Secretary, Pioneer River Farmers' Association, Mackay.

Bundaberg, 20th March, 1897.

DEAR SIR,—Your letter of 20th ulto. duly received; and in reply to your inquiry as to the appearance of the cane on the drained land, I may state that the cane looks splendid all over the drained land—*i.e.*, green and healthy. We consider that the air playing through the pipes must receive much credit for the healthy appearance of the cane, but moisture is needed to make cane. With all the fine appearance we have not the cane, owing, we feel certain, to the scarcity of rain, which we need badly.

In the North, where you have a much heavier rainfall, the drains must be beneficial. We note your remarks of the C.S.R. Co. A number of their managers have been here to see and report, and now have a great number of the staff we had in the laying of our pipe-drains at work on their Victoria Plantation, on the Herbert River.

I am, dear sir, yours faithfully,

ANGUS GIBSON (J.P.A.)

E. Swayne, Esq.,
General Secretary, Pioneer River Farmers' Association, Mackay.

Mr. T. WHITELEY then proposed and Mr. GEORGE STUCKEY seconded the following resolution, which was also carried:—"That, in the opinion of this Conference, a closer supervision in reference to the use of pigs as human food is necessary."

SEVENTH SESSION.

SATURDAY MORNING, 12TH JUNE, 1897.

THE session was opened by Mr. JOHN MAHON reading the following paper on

BREEDING AND TREATMENT OF DAIRY CATTLE.

BREED and individuality must be considered. The one is inherited from generations. The other is the result of influence and character of the animal. These influences affect the milk production through the constitution and blood production. In breeding for beef we select the animal which has a tendency to build up the body. In choosing an animal for the dairy we select one to

secrete milk. The greatest milkers are to be found in herds which have been specially bred for the purpose. It is not always that the good qualities of the parents will be transmitted to the offspring, as, if we are careless in rearing the calf, it cannot be expected that the good qualities of the parents will be found in it. We should by our treatment of the young aim at developing the characteristics of a dairy beast. In order to build up a good dairy herd, we must begin with a good milking strain regardless of breed. My selection is a good milker of any breed.

To obtain good results, we must have quality on the father and mother's side. It will be found that the cow will always throw back to the better breed; consequently, if cross breeds of a fair milking capacity are crossed with a good male animal, good milkers will be the result. The offspring will always inherit a higher merit on the male side. In most cases the sire has a greater influence on the characteristics of the offspring than the dam.

The rearing of the calf should begin before it is born, consequently the constitution of the dam must be considered. If a cow is in low condition at the time of calving, a healthy, good calf cannot be expected. The calf should be fed for the first week on pure sweet milk, and the supply decreased gradually for a period of four or five weeks, when it will thrive on skim milk. The bull should not be allowed to run with the heifers until they (the heifers) are two years old. There are several breeds of cattle suitable for dairying, and each person favours his own particular breed. Previous to the invention of the Babcock milk-tester, our ambition was to breed an animal to produce a great quantity regardless of quality, but now we must strive to breed an animal that will produce a quantity of butter fat.

Now, my idea on raising a dairy herd, is to breed animals best suited for the districts in which they are to be kept. For high, poor ridgy country, I would suggest a light animal, such as the Ayrshire or Devon, crossed with the best of the cows to be found in our present herds. For heavy black soil country, I would advise the Ayrshire and Shorthorn cross, which are considered to be strong, sound-constitutioned animals. When looking for cheese production, I would adhere to the Ayrshire and Holstein. The Shorthorns are good milkers, if bred for the purpose, and in some colonies have an average yield of 400 gallons of rich milk, and reach as high as 1,000 gallons. The Ayrshires, until very recently, received very little consideration amongst our herds, but are now considered preferable to the Shorthorn, and if selected from a good milking strain are difficult to surpass. The Jerseys, I consider, are of too delicate a constitution to withstand hardships, but if crossed with a good milking strain would hold their own amongst the best of breeds.

Feeding Cattle.

A cow may be of the best breed and possess good dairying capabilities, but, to obtain her true results, attention must be paid to her comfort and food. It is impossible for her to produce good rich milk unless the material necessary for its production—namely, good sweet fodder—is available for her. Knowledge of breeding must be assisted by skill or judgment in feeding—one without the other is useless. In order to place the industry on a sound footing, we must provide fodder for a time of need. Unless we adopt a thorough system of feeding, it will be impossible to establish a successful export trade. By the adoption of a system of feeding, we place ourselves in a position to keep up a regular supply of dairy products all the year round, and thereby give confidence to the home people that they can rely on a constant supply.

The great necessity of feeding cannot be too strongly impressed upon our dairymen. The cow is very similar and may be compared to a steam engine. The latter requires fuel to give us full steam capacity, and the former requires food (fuel) to enable her to attain her full milking capabilities. It is far better to keep a small number of cows and feed them well than a greater number and half feed them, for profit is only obtained when care is bestowed on our herds. The Queensland pastures are, in most districts, suitable for the

production of good milk, but, unfortunately, our seasons are so variable, that to depend on the natural pasturage would be absurd and ruinous. To be successful we must grow fodder during favourable seasons, and conserve it in the form of hay and ensilage for time of need. The most suitable food for milch cows is a nutritious succulent food. Hay, if dry, should be steamed before feeding it to cattle. Many cereals which grow luxuriously in our colony could be converted into hay or ensilage, but, often for want of a little care or knowledge in conserving, are allowed to go to waste. Ensilage is a splendid fodder, but it is absurd to think that it can be made from any rubbish; nothing but good, succulent fodder should be put into the silo.

The system of allowing the calf to suck the mother must be discontinued. The milk from cows suckling calves is not suitable for the production of a good article. The cow, under such circumstances, retains a quantity of milk in the udder, which often causes the udder to become inflamed, with the result that the milk is destroyed. In the case of heifers, it prevents the proper development of the milk-producing functions. Any member of the body neglected or misused will eventually become dormant and useless.

It is then evident to us that it is necessary to foster growth of the true characteristics of a dairy cow in individuals. It is absurd to expect a badly bred cow (from a dairying point of view) to produce good milk. There is a distinct difference between a beef cow and a dairy cow, and in building up a herd we must not lose sight of this fact. As we cannot, by feed, raise the quality of milk produced, it is at once evident that we must adhere to the rule of successful dairymen, viz.:—Breed for quality, and feed for quantity.

Mr. Mahon was warmly applauded for his paper.

Mr. M. O'Keefe (Lockyer) said that a great deal of dissatisfaction existed about the system of milk-testing at present adopted in factories. What suppliers of milk complained of was, that they had to rely on the ability and honesty of the owners and managers of factories for the test. He did not wish to cast a doubt on their honesty, but he had reason to suspect the tests were not always correct. For one thing, he thought the tests fluctuated too much to be always right.

Mr. Mahon said the only way to overcome the difficulty would be to have testers at the creameries. Then each supplier could see his own milk being tested. Milk, however, would always vary a few points every day, although it ought not to vary so much as 1 per cent.

Mr. Thynne said that every farmer who had cows ought to have his own milk-tester. They could be purchased, he believed, for about £3, and the use of them could be easily learned.

Mr. Deacon explained that in some districts in the South the testing was done in such a way that the operator did not know whose milk he was testing. This prevented favouritism, &c.

Mr. T. E. Coulson (Rosewood) said he belonged to a district where the chief industry was dairying. In parts couch grass was very plentiful, and consequently the milk was very rich in butter fat, the test sometimes going as high as 7 per cent. Of course the cows did not give a very large quantity of milk when it was of this percentage. He was a shareholder of the Lanefield Co-operative Dairy, which was one of the first institutions of its kind to start in Queensland. The great bugbear in co-operative dairying was the cost of the manufacture and distribution of the product. In the case of the Lanefield Dairy, if he remembered correctly, this cost amounted to about £800 a year. In view of this, he considered that, instead of having several small co-operative dairies scattered about a district, it would be far better for them all to combine and have one big central co-operative factory in Brisbane or elsewhere. This would also largely do away with gluts in local markets, a large factory being in a better position to export and otherwise distribute surplus butter when necessary. Another point was that steamers going north from Brisbane, had no cold storage accommodation provided for butter, &c., and consequently this

often arrived at its destination in the North in a bad condition. He had also been told that coastal steamers from Sydney and Melbourne going to the Northern ports of Queensland were provided with cold storage; and he would like to know if this was true?

Mr. JAMES WILSON agreed with the recommendation of the Chairman about the advisability of farmers possessing milk-testers, and he did not think there was much good in the Department supplying the farmers with improved stock unless they kept these testers.

Mr. T. WHITELEY (Rockhampton) said he regretted to say he had never seen Mr. Mahon in the Central district, but he need hardly add he would be very pleased to see him there. Dairy factories in his district were an unknown quantity, but the question was forcing itself upon the people there. With regard to the rearing of calves, he had never allowed a cow of his to suckle her calf for the last eight or ten years, and he had found that the calves could be fed on skim milk within a fortnight from birth. His brother always tested his cows, and thus knew exactly which were paying and which were not. With regard to the importation of butter from the south into Queensland, he might say that an immense quantity was now coming into their markets; but this did not take place every season, and, in fact, the local butter was often sufficient to glut the market. He looked forward to the time when both North and South would be able to co-operate in the export of dairy produce.

Mr. THYNNE stated, in reply to the first part of Mr. Whiteley's remarks, that a year ago the Travelling Dairy had had to be laid up, as there were no further applications for it. He was pleased to learn, therefore that there was a desire in the Central district for a visit from the Dairy.

Mr. WHITELEY said in this connection he would like to mention Mr. R. Winks's visit to Rockhampton, the only fault of which was that it had been too short. Its effect had been a great improvement in the dairying industry in that part of the colony; and he trusted that Mr. Mahon, or one of his assistants, would be able to visit the Central district at some early date.

Mr. W. D. LAMB (Yangan) asked how farmers, who sent their milk to cheese factories, were going to rear their calves, skim milk being beyond the question. In some places this was a serious matter.

Mr. MAHON said for the first couple of weeks the calves should be fed on pure milk. After that they could be fed on whey, together with a little lucerne, if possible. Of course, if whey could not be procured, perhaps the best thing was to destroy them.

Mr. M. O'KEEFE (Lockyer) asked—What is 3·6 milk worth to the farmer when butter is selling at 1s. 3d. per lb.?

Mr. MAHON: Sixpence per gallon, less the cost of manufacturing the cream into butter, which would be about 1d. per lb. This, of course, was applicable only to farmers using their own separators, and did not in any way refer to milk being sent to creameries.

Mr. CASWELL (Wallumbilla) believed in co-operation in dairying, but it was no use trying to run too many small factories. Rather let them combine and form one large central factory, to which all their cream could be sent. Then they could make a success of the business, and, moreover, produce an article that was suitable for the requirements of the London and other outside markets. They would also get a good price for their cream, as well as a dividend from their company. Under a system of a number of small factories, there were too many different grades of butter in the markets to permit of an export trade. Mr. CASWELL also gave some useful information relative to the rearing of calves and fodder for dairy stock.

Mr. WILLIAM DEACON (Allora), on the subject of winter fodder for cows, &c., said, any amount of Cape barely was being grown on the Downs for this purpose. The barley was sown in March, and it was an excellent winter feed for sheep, in some cases often preferable to lucerne. New lucerne may keep sprouting, but it does not grow much in winter. This Cape barley was grazed,

and seemed to suffer no injury thereby. With regard to ensilage, he preferred the stack to the silo. Professor Shelton had made an ensilage stack in the middle of his farm; and corn, lucerne, and setaria were used in it. A few slabs were laid on the top of the stack, and earth was put on the slabs. The stack was a great success, and the ensilage was relished by his cows. The maize made the best ensilage, although the lucerne was also good. From what he had seen, he did not think it necessary to put earth on the top of the slabs. One of the advantages of the stack silo was, that there was no cartage, as it could be made wherever the green fodder was growing, and he did not see why a farmer should not have four or five such stacks.

Mr. THYNNE mentioned that he believed, in the Rockhampton district, the Messrs. Archer had been making about between 400 and 600 tons of ensilage annually for some time past, and the average cost of it was, taking everything into consideration, including the cultivation of the maize, from 4s. to 4s. 3d. per ton. This ensilage enabled them to keep their stud and dairy herds going in such a way as no other establishment in Queensland was kept up. This showed there was nothing risky about ensilage, and that it could be gone in for with safety. They should not, however, be led away by disputes between stack and pit ensilage. Stack ensilage was very useful when it was desired to feed stock in the field. When a dairy was kept, it was best to have a pit, and chaff the fodder. In the stack a certain amount of the outer stuff must always decay and become mouldy, and this was to be expected. In the pit or silo there was very little of this. The silo at Gracemere was rather peculiarly situated, being on the side of a hill. On one occasion a large quantity of the ensilage was apparently ruined by some rain which got into it. To show the fondness of stock for ensilage, it might be mentioned that every bit of this seemingly rotten fodder was eagerly eaten by cattle. The round silo was used in some parts of the world. They were simply huge casks or tubs, without any studding, made out of 6 x 2 wood, which were fixed in position by means of iron rods. He intended to try and have such a silo made in Queensland at some future date, if possible.

Professor SHELTON stated, with regard to Mr. Deacon's ensilage stack, that, considering all the circumstances in connection with it, it had been a success. The interior had been free from mould, and had given an excellent quantity of good fodder. Still, there had been considerable rot on the outside, and, with regard to the weighting, there had been about 3 feet of earth on the top. Without this earth, he was afraid the stack would have been a failure. Stacks could be wired, but it was then necessary to keep continually wiring, twisting, and otherwise following them up, and even then there was always a considerable waste. A few weeks ago, he had inspected a stack silo, which had been put up on a platform, and an elaborate system of winches had been devised so that a great pressure could be put upon the whole mass. But, as a matter of fact, the resultant ensilage was nothing but a stack of worthless rubbish. It was a mass of woody fibre with all its juice squeezed out. Doubtless cattle would eat it, because there was no other grass to eat. However, ensilage, if made at all, was best made well, and half measures were of little use. It was best to chaff the fodder, and put it into a good air-tight silo. In material, his own silo had cost £23, but now it was up it would last for several years, and when not used as a silo it could be employed for a granary or for any other purpose. The best thing, of course, was always to keep it full of ensilage. Ensilage-makers in the States now fill a silo, and begin to feed out of it at once. Needless to say the ensilage would keep for years, if necessary. It was always safe in the silo. Weights were not now used in the silo, it being found cheaper to lose a layer of ensilage rather than go to the trouble of putting on the weights. The floor of the College silo was simply ant-bed. This silo contained about sixty tons of ensilage, which he considered would carry over twenty cows for about four months. In making similar calculations, they could reckon on a cow consuming about a cubic foot of silage per day. The College dairy stock, however, at that moment, was being kept upon what was generally looked

upon as a waste material in Queensland—namely, corn stover. Of course a lot of it went out as bedding, and might consequently be reckoned as wasted; but still the stock always got about 75 per cent. of excellent fodder out of it.

Mr. W. D. LAMB asked for information about the general cost of ensilage, particularly with regard to chaffing, elevating, &c.

Mr. THYNNE said that any machine that would do chaffcutting would do to chaff ensilage. Individual farmers who did not own chaffcutters, could doubtless hire them without difficulty, and the cost of a plain four-sided building could be easily calculated. In the College silo, tests of different kinds of timbers and other experiments were being carried out, so that in connection with it several expenses were incurred which the ordinary farmer would not be put to. In Canada, if he remembered rightly, only one thickness of inch tongued and grooved pine was used for the walls of silos, and perhaps this would also do in this colony, although many considered the Queensland pine was not as tough and as durable as the Canadian. However, even if it did decay, it would last a few years at any rate.

A gentleman mentioned that cornstalks could be cut up with a common machine, and that there should be little difficulty in chaffing this kind of fodder. The same delegate also asked how ensilage was to be kept from going bad, after the silo had been opened, in the event of the owner not being able to feed it out quickly enough to his stock.

Mr. GEORGE STUCKEY expressed his approval of the practice of supplying dairy stock with chaffed fodder during the winter months. He was also against allowing calves to suck their mothers; but when the former were fed on whey, he advocated adding a little pollard to it. With regard to the importation of butter, there were tons of it brought into Queensland from the south, and, as far as the price was concerned, he did not think it was likely to rise much higher, at present at any rate. In this connection he mentioned that shipments of Victorian butter which had been sent to England were being returned to Victoria, the price in the home market not being profitable enough evidently.

At the request of Mr. Wilson, Mr. MAHON gave an explanation of why the butter had been returned to Australia. There was, of course, always a market in England, but the price may not have been profitable enough for the exporters. Butter in England was selling at 10d. per lb., but at present 1s. 5d. per lb. could be obtained for it in Victoria. In fact, at that moment, the Victorians were not able to supply their own markets. If Queenslanders at present could not compete in their own markets with the Victorians who had to pay 3d. per lb. duty and freight, then they had better give up dairying altogether. In reply to a question of Mr. Coulson's, he might state that Victorians sending butter to Queensland ports, did not have the advantage of cold storage on the coastal steamers. They were in exactly the same position as shippers of butter from Brisbane to Northern ports. With regard to feeding calves, he knew farmers who used whey without pollard and with very successful results. At Trelawney, a little linseed was mixed with the whey, and this was found very satisfactory. However, there was plenty of nutriment in whey, including sugar and a good deal of mineral matter. They knew pigs did well on whey; and if there was nutriment in it for pigs, there must also be nutriment in it for calves.

Mr. M. O'KEEFE (Lockyer) concurred in this opinion of the feeding value of whey. One mistake farmers, however, made was to give their calves skim milk on Monday mornings, and this caused them to object to whey on the remaining days of the week.

Mr. W. H. STEPHENS (Beaudesert) agreed with Mr. Mahon in his remarks about the advantages of co-operation, but still the private factories, he thought, were good friends to the farmers. With regard to milk-testing, it should be remembered that the amount of butter fat in milk varied, and this could not be always satisfactorily accounted for, although the cow was doubtless responsible for it. It should not vary, however, so much as 1 per cent.; but it was not

uncommon for a cow to have 3·6 per cent. of butter fat in her milk one week and only 3·3 the next. He had no difficulty in hand-feeding calves. He brought them up upon skim milk; and although at first he had been troubled with the scours, he now had a good receipt for that complaint. With regard to a standard in milk-testing, the creameries in his district used from 3·4 to 3·8. If the milk went under 3·4, it was below the standard; if over 3·8, it was above, and consequently obtained a higher price. A defect in such a standard was, that an inducement was offered to people with, say, 3·7 milk to water it to bring it down to 3·4. Rape was an excellent dairy fodder, and was, moreover, very economical. It also made a very good green manure.

Mr. K. W. Scholz (Stanthorpe) supplied a quantity of practical information in the matter of feed for dairy cattle, together with several interesting details about dairy farming in Europe. He made special mention of the great use to which mangold-wurzel and beet roots were put in this connection.

Mr. T. Whiteley (Rockhampton) would not admit that Queensland dairymen could not compete with the Victorians. In his own district, the best local butter generally fetched about 3d. per lb. more than the "foreign" article. He would be glad of some information on the practical working of co-operation in dairying. His idea was that such dairies should be purely farmers' co-operations.

Mr. Mahon said that he agreed that in co-operative dairies, the majority of shareholders should be from the milk suppliers and farmers, but at the head of them it was essential to have a good business man with plenty of financial knowledge and tact. Farmers themselves were generally too much occupied directly with their own work to be able to devote much time to the small but necessary details connected with the business management of such companies.

Mr. Thomas Armstrong (Logan) also strongly advocated the advantages of co-operation in dairying, and stated that he would like to see a large co-operative farming company and butter factory established in Southern Queensland.

Mr. M. O'Keefe (Lockyer) concurred with Mr. Mahon in his remark about the absolute necessity of co-operative butter factories, &c., being well managed.

Professor Shelton replied to some of the inquiries that had been made. Ensilage began to decay from the outside, never from within. Consequently when it was necessary to feed it out, start from the top and work downwards, and if it was used every day none would ever be lost by rotting. He cautioned them against growing Johnson grass as a winter fodder for dairy cattle. Once established on a farm it was bound to become a nuisance, and it was a plant that could never be got rid of.* It had its good qualities, but in winter it was useless, and on the whole a worse pest could hardly be introduced on to land.

Mr. A. Watt (Beenleigh) mentioned Swede turnips as a valuable dairy feed, and it had struck him the College land would be very suitable for this crop. A heavy return could always be depended on in a fair season. In Scotland the Swede turnip was the mainstay of the farmer in winter, and on it he fed both bullocks and cows. It had been objected against Swedes, as a dairy cattle feed, that they imparted a flavour to butter made from milk obtained from cows fed on them, but although this was true of white turnips he did not think it was the case with Swedes.

In reply to Mr. Caswell, Professor Shelton said Johnson grass was a sorghum, which it resembled except that it had a very much finer growth. It was a coarse grass, with a flower very similar to ordinary sorghum, but it was perennial, and filled the ground with a dense mass of fibrous roots. As a pest it was a fair rival to nut grass. In reply to Messrs. Adams and Wilson, the Professor said cow pea had been used a good deal for ensilage, but the reports had not been altogether favourable. When used, however, in combination

*An article on the destruction of Johnson grass appears on another page.—Ed. *Q.A.J.*

with maize or sorghum, it was not so bad. Cow pea should be sown in the spring, as it was a plant that loved and required hot weather. Plant in drills if the crop was required for seed; but if it was desired to smother weeds or to plough the vines under, sow broadcast. About a bushel of seed was required to plant an acre.

Mr. MAHON stated that it was very seldom that Swede turnips tainted milk, and even then it was got over if the milk was properly aerated. In New Zealand a large amount of Swedes were used for dairy stock, and it was the same in Victoria. In the latter place he had never had any experience of butter being tainted by cows being fed on this crop. In this connection Professor SHELTON said that lucerne and many other fodders were apt to impart a flavour to milk if the cows were fed at the wrong time. Such substances should always be fed after milking, and not before, and if this was done no evil effect would be noticed. When saying—do not feed these forages before milking, he meant about an hour before. There was no objection to let the cows eat them while they were being milked.

Mr. THYNNE mentioned cotton-seed meal as a cattle feed, and pointed out that it was a local product that could be obtained very reasonably at Ipswich. In America it was used to a very great extent. A large amount of bran was sold in Queensland at from £5 to £6 per ton, and this cotton-seed meal could be purchased at about £3 per ton, although it was said there was twice the nutriment in the meal that there was in the bran. Cotton-seed meal, if not used in too large quantities, was excellent to mix with other foods for dairy cows. The best results were obtained when about 1 lb. per day was given to each cow, a greater quantity affecting the texture, and perhaps the colour, of the resultant butter. He specially mentioned it to them, as it was a farmer's product well worthy of a trial, and he might add that he had used it himself with satisfactory effects. Mr. Thynne also stated that he hoped to see established in Queensland a proper dairy school, in which not only would be done the ordinary work of creameries and butter-making, but in which also would be given practical instruction in the whole business of dairy farming. He trusted to see where they now were, the commencement of a model dairy farm, where young, and doubtless old, could get information and instruction in that particular branch of farming. He referred to this, as he believed one of the difficulties of dairying in the colony was that of getting competent and reliable men for their creameries and factories, and he hoped that before long none but those who had gone through a proper course of dairy instruction would be accepted by farmers as fit to take charge of butter works and creameries.

Mr. J. LELY (Ingham) stated that in the North it was considered that butter from the South of Queensland was generally superior to butter imported from New South Wales and other southern colonies.

This concluded the discussion.

Mr. E. SWAYNE (Pioneer River Farmers' Association, Mackay) then read the following paper on

FARMERS' ASSOCIATIONS.

IT is not until an endeavour is made to bring them within the scope of a single paper that the magnitude and importance of the subjects included under the above heading are realised, for in farmers' associations and their outcome—co-operation for the attainment of objects of mutual benefit—lie the means by which the cost of production and of sale of crops can be lessened, common interests protected, desired legislation procured, and useful information obtained and disseminated. In short, it is a lever capable, if properly used, of raising the agriculturist from the position of having to work the longest hours for the most meagre recompense of any class in the community, to one in which he will receive a fair return for the risks he takes. Unfortunately, as a class we seem to be the last to realise that in unity is strength, and this apathy on our part seems difficult to account for when the possibilities for good are so apparent. But it is encouraging to note that in nearly every

country there are signs indicating that in these days of rings amongst middle-men, unions amongst wage-earners, and combination generally on the part of those he deals with, the farmer is beginning to awake to the necessity of similar action on his part. One instance is found in the German and other European land banks, whereby a system of co-operative credit, resting on a mutual unlimited liability requiring a most rigid scrutiny as to every candidate's ability to pay his share of the money borrowed before admittance as a member, and a keen supervision over the manner in which loan money is expended and its application to reproductive work, have enabled the farmers in the countries where they exist to borrow money at a very low rate, where formerly, in many cases, their life was one continual effort to pay interest to the money-lender. And these banks are the more noteworthy when it is remembered that very few of them ever received any assistance from Government, the only interference generally being a strict audit by Government officials, "although this in itself, when passed, is an advantage constituting to investors an assurance that the banks are a safe medium for investment." Again, the manner in which, by co-operative dairying and later co-operative bacon-curing, Denmark has, within the last few years, largely increased its national wealth in the way that is of all ways the most to be desired, it having gone into the hands of the small producer. Then we have the farmers' associations in America that have made the farmer a power in politics. And yet another instance nearer home is the organisation in South Australia that has been the means of its members obtaining a higher price for their wheat, and has enabled them to effect a considerable reduction in the purchasing of their supplies. The co-operative stores in England and Ireland might also be quoted, and even in Queensland a move has been made. But the time has now arrived for us to earnestly consider the steps to be taken to still further strengthen ourselves for holding our own in the world's markets.

We are rich in natural advantages; and if we are true to one another, everything else necessary is within our reach—this Conference, I trust, being the first step towards the farmers of Queensland working unitedly to obtain what may be termed artificial advantages to supplement their natural ones.

In these days of competition, reducing the cost of production and the charges as between the producer and the consumer, so that a fair profit to the former may be left after his crop has been disposed of, are the first items for the consideration of every farmer, and here associated action is most useful. Unitedly we can dispose of our crops to the best advantage, we can arrange for their carriage at the lowest rates, buy our supplies co-operatively—"for what we consume on the farm we sell again in the shape of farm produce"; and like any other business men, we must endeavour to buy what we afterwards sell, in the cheapest market. In fact, in a country like this, where the different districts vary so much in climate that nearly each has its special product, there is nothing to prevent us arranging a system of purchase and interchange by which a sugar-grower in the North may buy maize direct from a Downs farmer, and between them, secure to themselves the profits that now support an army of intermediaries. All that is required is the thorough organisation of our calling, and we want branches with their officials responsible for the purchase, delivery, and quality of stuff sold or exchanged with members of another branch of the same organisation situated at, perhaps, the other end of Queensland. Or if we desire to borrow money for improving our properties and for other reproductive purposes, on the most favourable terms from first hands, we have already instances that, on joint security, such can be done even in this colony. As an instance I could point to schools of art and other institutions which, upon very little other security than the character of the men composing the committee managing them, are now getting money at 6 per cent. Unitedly also we can better resist demands for exorbitant rates of wages; and this matter in tropical agriculture, requiring such a large proportion of hand labour for its successful prosecution, is most important. Again, in a young country like this, with agriculture as

yet in its infancy, and with very little done so far in that respect, our requirements in the way of special legislation bearing on our calling daily becomes more apparent, and by mutual discussion and concerted action on this point we can so mould it that when passed it will be suitable for its intended purpose. Local governing bodies, also, with the increased powers that it is suggested should be given them, require combined action in order that the farmer may be fairly represented on them. Another sphere of action for association work, is the collection and dissemination of information amongst members. So many in Queensland, who have just started on the land, being new to such work makes this very important, and already the interchange of such between kindred societies in the North has been most beneficial. Government departments also, through representative bodies, are afforded a means of communication upon subjects of importance to agriculturists, whom otherwise they would find difficult of access. But although the Pioneer River Farmers' Association, and other similar bodies, have already done good work for their members, many links are yet wanted to make the system complete, and I hope that those present will give some attention to the matter when many ways of improving their position by associated action will be apparent. But before leaving this part of my subject, I will remark that, in the sugar industry particularly, where large bodies of farmers are growing cane for one mill, is there scope for its action, as it affords a means by which the growers' requirements or grievances can be placed before the management in a concrete form with good results to both parties. In fact, more than one case has come under my notice where the management of a mill have expressed gratification at action of this kind; and only the other day I read an article in the *Louisiana Planter* or *Sugar Bowl*, pointing out the good work being and to be done for sugar-cane growers in that State, which might have been written expressly for Queensland. The same paper contained an account of the organisation of beet-growers in California, where not only had the growers (as in many cases the cane-grower has here) a check weighman on the weighbridge, but also a check chemist in the laboratory, "for in this instance the price was determined by the sugar content of the beet."

The next thing to consider is the best method by which one immense alliance or association can be formed, bringing into touch the farmers and pastoralists throughout Queensland, and having for its object this political and industrial organisation. Once that is accomplished, we have the means of gaining every advantage to which we are legitimately entitled. To do this, what is required is branch associations in every district, each with representatives on a central body. These local associations, again, should be composed of branches in every locality where a few farmers are settled together, as it is useless to expect men, after a hard day's work, to ride far to a meeting.

Each of these little groups should send representatives to the central committee or executive of their district, which could meet quarterly or as often as business required; and these district bodies should, in their turn, appoint delegates, who would compose the grand council of the whole body of Queensland farmers, meeting once every year, or as often as required, and dealing with matters concerning agriculture generally. The district bodies and their smaller branches would in the meantime each do good work in connection with local matters. It was only after altering its constitution to these lines that a large Northern association, that is now a benefit to every farmer residing within the sphere of its action, has been able to do good work. Previous to the alteration, it attempted to keep all its members in one body and work a large district, and failed. Now it has a central council, meeting once every two months, on which every branch is represented proportionately to its membership, and not only has it done good work for its members on nearly all the lines I have mentioned, but it has called into evidence a sort of *ésprit de corps*, or feeling of "stand by one another against all comers," that has carried it successfully through a parliamentary election and several elections for the local governing bodies. The result has been that the farmers there occupy

a position in public estimation very much higher than was formerly the case. So far, however, as the political work of the central council is concerned, I would not desire that it should touch party politics; its platform would be one which excluded all public questions not immediately affecting the individual life of the farmer. Agriculture has now been given a separate Government department, with a special Ministerial head. While the farmers are forming their local organisations, which would inevitably precede the establishment, perhaps for some time, of the grand council, there is one work which the Department might undertake forthwith. In Britain we have organisations enabling the Government to issue periodically statements showing the condition of the labour market in the various trades and centres. This tends to check oversupply of labour, and at the same time to prevent want of it in the trades and places enumerated. Now that we are to have the monthly journal shortly to be issued by our Agricultural Department, it might publish in each issue such information as will lead to the better distribution of farm labour and farm produce in this colony. At present men draw Government rations in one part of the country, while labour is not procurable in another part. In one district we may be wanting maize and other produce and are importing it from other colonies, while in another the produce is rotting on the ground, because it would not pay to harvest it. If the organisation of farmers did no other good than the remedying of such evils and the association of farming interests, its establishment would be fully justified.

Mr. JAMES WILSON and several others complimented Mr. Swayne on his paper.

Mr. WHITELEY stated that some years ago he had tried some of the lines advocated by Mr. Swayne in connection with farmers' associations, but for various reasons had not been successful. Mr. CASWELL also stated that an effort had been made to bring the various associations in the Maranoa district into closer union; and although the immediate objects of the movement had not been accomplished, still a great deal of good had been otherwise done. Mr. WATT mentioned that the old East Moreton Farmers' Association, about the first agricultural society formed in the colony, was constituted on the principle advocated in the paper read. Brisbane was the headquarters of the association; and it had branches at the Logan, the Pine, Oxley, and Moggill. At Brisbane and at the branches, meetings were held, at which papers, &c., were read and discussed, and the whole organisation worked very well indeed When the present National Association was formed, however, the East Moreton Farmers merged into it, and this practically closed the branches. The society to which he belonged at the present time, however, had only recently formed a branch at Mount Cotton, and intended to form similar branches all over the Logan district. He thanked Mr. Swayne for his paper, and pointed out that the Conference itself had done a great deal to place them more in touch with each other all through the colony.

Mr. THYNNE said that it was only some time ago that he had expressed his regret at the fact that farmers were giving up the administration of their shows. He had attended a great many shows during the last year or two, and was quite sure they were generally not held in a way most satisfactory to the farming interest. They were not what they ought to be, or what they might be made. Very often it appeared they were got up for the purpose of securing the Government grant rather than from any educational object. The whole matter was a big subject, but it was one which they, as representatives of agricultural associations, should earnestly consider. Mr. Swayne's idea of branches was a very good one, and by it they could make their influence more greatly felt. Again, by a closer union of all the agricultural societies of Queensland it would perhaps be possible to arrange for a grand movable show to be held each year in a different centre of the colony. Such a show, apart from its own immediate uses, would be very helpful in bringing farmers in different parts of the colony more in touch with each other; and, moreover, it would give them greater facilities for seeing each other's work. In any event,

combined action for an improvement in their present show system was very necessary. They had too many shows, the majority of which, instead of being fine district or fine colony shows, were simply parish shows, to which nobody went except for a day's amusement.

Mr. J. E. Noakes (Maryborough) said that so far as his own society was concerned, most of those at the head of it were business people, but the membership of farmers was not good as compared with that of the townspeople. The committee was composed of members from all the various parts of the district the society operated in. It was to be regretted that farmers themselves did not exhibit at these shows as readily as they might. Even as they were, however, he thought the present shows did a fair amount of good, although of course there was room for improvement in them. Mr. Noakes concluded by expressing his appreciation of the way the Conference had been conducted; and with regard to the Agricultural College itself, he thought a more suitable site could hardly have been chosen for it.

RESOLUTIONS.

The following two resolutions, which had been prepared by the delegates from the sugar-growing districts, were moved by Mr. T. H. Wells, and were both unanimously adopted by the Conference:—

1. That an official inspection of weighbridges (and weights used thereon) of mills which purchase sugar-cane, be recommended; also, that growers be allowed to demand, if necessary, a check-weighman, as under the Collieries Act.

2. That each of the members of this Conference join in a hearty vote of thanks to the Department for the hospitality shown, and to the president (Mr. Thynne) for the most able and effective manner in which he has conducted the proceedings.

The following resolutions of the Recommendations Committee were also carried:—

1. That this Conference expresses its sympathy with any effort on the part of the Imperial authorities to protect sugar and other colonial produce against the bounty-fed competition of foreign countries.

2. That this Conference expresses its hearty appreciation of the excellent arrangements made in connection with its organisation by the Department, of the advantages reaped, and the still greater advantages to which it is likely to lead; and the hope is expressed that such Conferences may be repeated in the future at stated intervals.

In proposing the last-mentioned resolution, Mr. A. Watt described the Conference as the best gathering of its kind he had ever attended, and he was doubtful if anything, during his long connection with Queensland agriculture, had given him more pleasure. He also congratulated the Department on their selection of the College site. Messrs. T. Whiteley and J. Lely also supported the resolution.

In reply, Mr. Thynne thanked the delegates, not only for the kindly sentiment that had been expressed, but also for the cordial active interest and support which had been given to him and the Department all through the Conference. It had been a most interesting and agreeable and also, he thought he was safe in saying, a most useful and instructive one. Apart from that, they had become familiar with each other, and many who had formerly only known their fellow-delegates by name now knew them intimately, and as far as he himself was concerned he was glad to say he had gained many personal friends during the Conference. Of course he was not the only one to be thanked in the matter. He was the nominal head of his Department, but unless he had good men under him he could make but a poor show in its administration. With regard to the detailed arrangements of the Conference, perhaps he had put Professor Shelton a rather severe task when he had asked him to provide for the whole Conference, but he did not think much fault could be found with what had be done for their convenience. As the College students

would be provided for and treated in exactly the same manner as they themselves had been, from what they could see there was not much danger of the boys being neglected in this respect. He would also like to thank the specialists of the Department—Messrs. Mahon, Brünnich, and Benson—for their services during the Conference, and particularly all those gentlemen who had prepared papers. (Cheers.)

Professor SHELTON briefly responded, and a vote of thanks to the Recommendations Committee concluded the Conference.

FINAL PROCEEDINGS AND TRIP.

AT dinner on Saturday very cordial wishes were expressed for the success of the College. In reply, Mr. THYNNE stated that they had had within the last year to clear and fence the land, select the site for, let the contracts, and have the buildings erected; but probably no act in his thirteen months' administration of the Agricultural Department had given him greater pleasure than the establishment of the College. Professor SHELTON also gave some particulars relative to the admission of students. The aim of the instruction, he added, would be to instil into the minds of the youths and young men attending it a genuine love of agriculture.

After dinner all the delegates were photographed by Mr. F. C. Wills, of the Agricultural Department. At 4 o'clock the great majority of the delegates left by train for Warwick, where they arrived at half-past 10 after a pleasant run across the Downs by moonlight. Mr. J. V. Chataway, M.L.A., who had attended all the sessions of the Conference, accompanied the party. It was also joined from Brisbane by Mr. J. C. Stewart, M.L.A. Mr. Thynne remained at Toowoomba, but rejoined the members of the Conference on their way back from Killarney, and returned to Brisbane with them. Next day the delegates, with the addition of Mr. Arthur Morgan, were taken by train through the fine farming districts that lie between Warwick and Killarney. At the same time an inspection was made of the recently established State experiment farm at the Hermitage, about five miles from Warwick. Work has apparently been vigorously pushed on at the farm; the overseer's cottage, among other things, being now practically completed. A couple of hours were also spent at Killarney. In the afternoon the delegates returned to Toowoomba, several of them going on from there to Brisbane or to their respective homes, while a number remained behind for the purpose of visiting some of the chief butter and cheese factories in the neighbourhood.

Fruit-Growers' Conference.

AT THE EXHIBITION BUILDING, BOWEN PARK, 18TH JUNE, 1897.

A LARGELY attended Conference of delegates from the Fruit-Growers' Associations, and Agricultural, Horticultural, and Farmers' Associations from all parts of the Australasian colonies was held in Brisbane, commencing on the above date. Representatives of the Departments of Agriculture of New South Wales, Victoria, South Australia, New Zealand, Tasmania, and Queensland were present. The following papers were read, and were followed by interesting discussions, which brought out much valuable practical information:—

How to Open up New Markets for our Fruits, by F. C. Smith, South Australia.

Over-sea Carriage of Fruit, by L. M. Shoobridge, Tasmania.

Co-operation in the Fruit Industry, by A. Lorie, New Zealand.

Storage of Fruit, by W. E. Bovill, Tasmania.

Fruit Packages, by A. H. Benson, Queensland.

Co-operation, by H. Bloxham, New Zealand.

Economic Fruit Culture, by G. H. Grapes, New Zealand.

Dried Fruit Industry, by Jas. Williams, Victoria.

Tropical Fruit Culture, by L. G. Corrie, Queensland.

Apple Culture, by F. F. Butler, Tasmania.

Berry Culture, by George Neilson, Victoria.

Nut Culture, by J. Mayo, Government Pomologist, Wellington, New Zealand.

The Olive, by Owen Crompton, South Australia.

The Propagation of Fruit Trees, by John Williams, Queensland.

The Propagation of Fruit Trees, by T. Farnell, Queensland.

Orchard Manures, by W. S. Campbell, New South Wales.

Strawberry Culture, by W. S. Williams, Victoria.

Orchard Planting and Cultivation, by A. Lansdowne, New South Wales.

Fruit Canning, Drying, &c., by W. J. Allen, Fruit Expert, New South Wales.

The Dried Fruit Industry, by C. B. Luffmann, Victoria.

The Dried Fruit Industry, by E. Semmens, Mildura, Victoria.

Lemon Growing and Curing, by W. S. Williams, Victoria.

Notes on Curing Citrus Fruits, by N. B. McKay, Mildura, Victoria.

Insect Friends and Foes, by H. Tryon, Queensland.

Fighting Insect and Fungus Pests, by J. C. Blackmore, New Zealand.

The Mango, by James Mitchell, Queensland.

Economic Entomology, by Chas. French, Victoria.

The Development of Wine Culture in Stanthorpe, by R. Hoggan, Queensland.

The Chemistry of Brandy-making, by V. R. Gosche, New South Wales.

Brandy-making, by L. Frere, New South Wales.

The full details of the Conference, together with the papers read and the discussions arising out of them, will be published by the Department of Agriculture in a special volume, which will shortly be issued.

Opening of the Agricultural College.

THE official opening of the Gatton Agricultural College took place on Friday. 9th July. At the invitation of the Minister for Agriculture (Hon. A. J. Thynne), the ceremony was performed by His Excellency the Governor (Lord Lamington). A large party of members of both Houses of the Legislature and other gentlemen visited Gatton, and lent countenance to the function. Amongst those who travelled by the special train to the College were:—His Excellency the Governor, accompanied by Captain Pelham, A.D.C., Hon. A. J. Thynne (Minister for Agriculture), Hons. P. Perkins, J. T. Smith, A. C. Gregory, J. Cowlishaw, F. T. Brentnall, W. Forrest, W. G. Power, A. H. Barlow, B. D. Morehead, J. C. Heussler, and G. W. Gray, MM.L.C.; Hon. R. Philp (Minister for Works), Hon. D. H. Dalrymple (Minister for Education), Hon. J. R. Dickson (Minister for Railways), and Messrs. Groom, Smith, Daniels, Murray, Castling, Stewart, Kidston, Battersby, King, Browne, Boles, Newell, Cribb, G. Thorn, A. J. Stephenson, Jackson, Cross, Dibley, and Bell, MM.L.A ; Mr. P. R. Gordon (Chief Inspector of Stock), Mr. A. H. Benson (fruit export), Mr. J. Mahon (dairy expert), Mr. A. J. Boyd (editor of the *Agricultural Journal*), Hon. W. J. M. Larnach (New Zealand), Messrs. C. J. Pound, G. Woolnough, F. W. Ward, H. Tryon, C. A. Bernays, and J. G. Anderson.

The party were met on arrival by the Under Secretary for Agriculture (Mr. Peter McLean), and Professor Shelton, and under the guidance of these gentlemen, made a thorough inspection of the College premises and the lands which so far have been worked. In consequence of the long prevalent unfavourable season the fields presented a rather parched appearance, and the little cultivation that had been attempted could hardly be taken as illustrating either the value of the methods employed or the potentialities of the land selected for the initial efforts. It was found that 242 acres had been cleared and "grubbed," and a good proportion of that broken up. A crop of 16 acres of maize had already been taken off a plot on the river bank, and had yielded sufficient ensilage to fill the "silo" shed. Over 300 varieties of experimental wheat had been planted, each sort being carefully marked and ticketed. Promising crops of vegetables and green stuffs were making headway. Much interest was manifested by the visitors in the College dairy herd and the buildings provided for the accommodation of the stock. Two hours were spent by the guests in this way, after which the whole party assembled at luncheon in the dining-hall. Subsequently, at the invitation of the Minister, His Excellency the Governor and the visitors adjourned to the main lecture-room, where the students were assembled, and where the opening ceremony was performed.

Professor SHELTON said: Your Excellency, Mr. Thynne, and Gentlemen,—It seems proper that I should say a word to you this afternoon concerning the work of the last six months in connection with the organisation of this College, and the various steps by which it has assumed its present position. I trust I need not apologise for the evident rawness of the surroundings of these buildings. This will strike you at the very outset, but you and these friends must bear in mind that less than a year ago this entire property was but a virgin forest. There had not then been a single acre cleared, and not a furrow had been turned up to the time of commencing operations in November last. From all this it will be clear enough, perhaps, that considerable work has been done in a direct and practical way. I may be pardoned, I trust, if I offer you a few

facts concerning the nature and scope of this work. Practical men will appreciate all this when I tell you that at the outset we had not an acre of ground we could call our own in the sense of complete occupation. We had not a single field, not a building upon the place except a rude hut on the banks of the Lockyer; and when we came here on the 1st of January, we had to turn our teams out and go to work with one eye regulating the work and the other on the horses for fear they would escape. So that there were not a few difficulties to encounter. That leads me to a statement of what has been done in this time. Almost exactly a year ago to-day the work was begun on this building. The contract was let in June, and the work began shortly afterwards. These buildings speak for themselves; they show you very considerable buildings which were erected under the contract system. We have this, the main College building, which has a library, two lecture-rooms, a third detached and three considerable offices, with a broad veranda which surrounds the whole. The veranda is all available class-room. We have three dormitories, which we label A, B, C. They have accommodation for sixty pupils and bachelor teachers. Then we have the dining-hall which you have just now occupied. They are all very complete and quite satisfactory. All this, however, is quite outside of my particular work, which has been the improvement of the farm. I wish to call your attention to what has been done in this particular line. We have put up since November, I think, all told, between twelve and thirteen miles of fencing. Seven miles of this is of top-rail and 3-barbed wire. This is a very good fence, as I am sure you will all say. We believe in good work. Good fences enable one to sleep nights. They conduce to friendly relations with one's neighbours, and an investment in good fences is never repented. We have two miles of top-rail fence and three miles of proper fence without barbed wire. These fences fairly meet present requirements, although they leave rather large paddocks. We ultimately expect to have a road from the station through the estate round the Lockyer, so that there will be a means of communication between the Lockyer and the railway. It will involve much planning and road-making, but we expect to do it by students' labour. We have made certain permanent improvements in the line of buildings. The stables which you have seen are 51 feet by 21 feet, and give accommodation for eight horses. There is a large room and a small room, bays for wagons, and a storeroom for grain and hay. Then we have a "silo" measuring 12 feet by 16 feet, having 16-feet posts and a capacity for 60 tons of ensilage. Inasmuch as a cow will consume about a cubic foot of ensilage per day, you can figure out—those of you who are of a calculating turn of mind—how much feed there is in this particular building. Then, too, we have the men's quarters, which many of you, perhaps, have inspected. It is designed for the accommodation of bachelor labourers, and has convenience for six men at the present time. We have, in addition, the cowsheds, a building 35 feet by 32 feet, giving accommodation for fifteen head of stock. These have been constructed hastily, to meet present requirements, but I believe they cover no regrets. I believe they are a substantial class of building, which will meet the future needs of the school. Your Excellency, Mr. Thynne, and Gentlemen—In all our plans and calculations in respect to this school, we have proceeded with the idea foremost that the school must, as soon as possible, in all practical respects, be self-sustaining; that we must here, upon the place, grow our own potatoes, vegetables, maize, wheat, and hay, so that we may be a self-sustaining community. (Applause.) This idea has been impressed upon me by the Minister, and has been cordially echoed by me to subalterns of all grades. (Applause.) You have noticed the cultivation areas below. That all has been undertaken with the view of meeting our present needs, and has no reference to markets outside. We shall, I hope, soon make our own butter, and it will no doubt interest you to know that we begin killing our own beef next week. We hope very soon indeed to meet our own requirements in respect to the things which go to maintain animal existence. So much, Your Excellency, for this particular branch of our duties and responsibilities. There is one other matter I wish to

speak of more particularly, and that relates to our students. On the 30th June we had an examination of candidates. At that examination twenty-four pupils passed satisfactorily. These you see before you now. These young men come from very widely separated districts of the colony, and it may interest you to know something of their aspirations—what they are driving at. I have had occasion just now to look over the papers which they signed on entering the College. Of the twenty-four students, exactly twenty write themselves as expecting to be farmers. Two state their intentions to be graziers. One is uncertain, while another gives a mercantile profession as his aspiration in respect to business. The boys come here, you will see, meaning business. They come here not merely to escape farming. I have seen agricultural colleges which were crowded with students who came to escape farming. This makes all the difference between success and failure in our work. It is very gratifying to us teachers, this last fact. These are, you will observe, young men well advanced in life. The average age of students is eighteen years, which is two years beyond the minimum stated for admission to this school. So we are not here as children to take up the little things, but to begin with earnest work and to go with earnest purpose into life. I know how great is your interest in the important subject of agricultural development in the colony; and I cannot help thinking, as I face these gentlemen to-day, of the great work done by a countryman of Your Excellency's, Sir John Bennet Lawes, the man who has done more to elevate the occupation of a farmer than any other living man. I am proud and happy to say that his life and work is nowhere better appreciated than in America. The Government of the States has recently published large volumes of his experiments, all of which have exercised the most powerful influence upon agriculture there. I hope it will have the same influence here, for that influence is not easy to estimate. I believe, in conclusion, Your Excellency and gentlemen, that among all the enterprises inaugurated in this jubilee year of Her Majesty, none will tell of greater good to the colony than this Agricultural College, which is not merely for the development of farming, but to induce experimental work. We hope to bring forth new facts, new truths in agriculture. Half of our strength will lie with the trifles. On behalf of myself and the pupils I welcome you to the school. I hope your stay has been a pleasant one, and that you have been enabled to see something of our hopes and aspirations. (Applause.)

Hon. A. J. Thynne said: Your Excellency and Gentlemen,—After hearing the explanation given by Professor Shelton, it now remains for me to supplement, to a slight extent, the information he has given, rather to remove some misconceptions as to the outlay on these premises. I may inform you that the contract price for erecting the buildings amounted to £5,070. That included the principal's residence, the dormitories, the dining-hall, and the necessary out-offices. It included also the residence which is now occupied by the farm overseer. In addition to that, the outside expenditure to 30th June, 1897, upon all the work done and described by Professor Shelton, upon the purchase of all the machinery and stock which you saw, amounted to £3,854 6s. So that the total outlay was under £9,000.

Mr. Kerr: That does not include the price paid for the land.

Hon. A. J. Thynne: It does not include the price of the land. The Department is charged with the price of the land at the rate which would have been charged for it had it been selected—something over £6,000. So that the total cost of this magnificent estate, which is now devoted to future generations in the great cause of agriculture, stands to this colony at a cost of under £15,000. (Applause.) In asking you, Your Excellency, to come to-day to formally inaugurate the great work initiated on this occasion, I cannot do so without saying how pleased we all ought to be that Queensland has awakened to the necessity, which all other civilised countries have recognised, of taking pains in the education of the people in agriculture. Queensland has, up to the present, been almost alone in the absence of any organised or

completed system of agricultural education. In every country—not only in Europe and America, but in almost all civilised countries—special pains have been taken in giving the rising generation facilities for obtaining knowledge in the art of agriculture. There is scarcely any industry in countries like Australia, great as their progress has been—I do not limit it to agriculture—that is not in need of, and would not be the better of, a scientific and thorough education of the people employed in it. (Applause.) Although I set great store on the necessity of advancing agricultural education, I do hope the efforts of the Government will not be limited to that branch of industry. In presenting these students to Your Excellency to-day, I cannot ask you to speak to them without feeling a great amount of grave anxiety as to the future these young men have to make for themselves. I look upon them as the pioneers of what I hope will become an army of agriculturists, who will in the future, instead of engaging in bloody battles, fight peaceful ones for the development of this magnificent country we have at our disposal. (Applause.) We who have, most of us, gone through the battle of life cannot but look with fatherly interest and goodwill upon the young men who are now commencing to pursue their course. I ask you now, Your Excellency, to declare this institution open.

His EXCELLENCY said: Mr. Thynne, Principal Shelton, and Gentlemen,—I have indeed great pleasure in being here to-day, and at having had an opportunity of inspecting this institution. I think what I say will not be regarded as over-complimentary—for my opinion, I think, will be endorsed by others who like myself have come as strangers to the place—when I say that it is wonderful what has been done in the short space of time mentioned by Professor Shelton. Further, having inquired into what is the organisation and the proposed system of instruction, it seems to me to be most complete, most thorough. I understand that every conceivable branch of agriculture will be thoroughly developed, and that training will be afforded for those anxious to undertake even the minor industries of poultry and bee keeping. It pleases me to see what comfortable, and at the same time what modest and simple, buildings have been erected for the resident students; also I observed in the various rooms that notices have been fixed indicating that, without undue severity of laws, there is to be a certain amount of disciplinary provision. I think it is interesting to know, as I understand from the Minister of Agriculture, that three days a week are to be devoted to lectures and what I might call book-work, and three days to manual or field work. The three days in the field are, I understand, to be a financial recompense for the instruction that is given to the students on the other three days, and it is very gratifying to hear from Professor Shelton that the institution is to be self-supporting. The most important thing of all is the magnificent area of land which is attached to these buildings—an area, I understand, far larger than is possessed by any other agricultural college in the neighbouring colonies, chiefly so because we rejoice in large areas. It is a further particular advantage that within the 1,700 acres around us you have three distinctive features of soil. First of all, you have rich land which can be easily cultivated; then the poorer land, such as these buildings have been erected upon, and which ought to afford useful lessons as to the best means of deriving profit from inferior soils; and again between us and the railway station is a marshy tract where valuable instruction may be given in systems of drainage and so on. I think the Government of Queensland have taken a right step in bringing about the establishment of such an institution as this. I understand it is the first College in Queensland, and very rightly the inauguration of the first college in Queensland should be that connected with agriculture, upon which this country is bound to look in the future as its great mainstay and most productive industry. In these days, when we seek world-wide markets, success in competition depends upon two primary factors: One is that your goods should be of the first quality; and another, that they should be produced at the lowest possible cost. These are the two necessary factors in regard to competition

when you seek it outside of your own country. Also, there is an indirect benefit—a smaller one—which should result from such an institution as this. Where industry is stimulated in the direction of the manufacture of goods of the best quality, it gives to the general public standards of excellence, educates their tastes, and in one way and another stimulates the whole of the producers of the country. This institution may be regarded as a centre in which may be focussed the agricultural information of the world. It is a kind of clearing-house, and those who attend the lectures and are resident students, will become possessors of knowledge obtained, not only from the experimental grounds, but from the experience of men in every other civilised country. One feature, which I have already alluded to, I think is of the utmost importance. It is that the students should have some sort of discipline. They should learn habits of industry, and how wisely to distribute their hours of labour. Above all, supreme attention should be given to the development of their faculties of observation. These are all qualities absolutely essential in these days for the career of a successful farmer. Those who have merely a technical knowledge of the theories of agriculture, and go to work on plans which they have seen applied in the old country—those who engage in farming without practical experience—generally spell failure for themselves. Not that I disregard the importance of ordinary farm life. But in ordinary farm life, in modern times, you cannot acquire that scientific knowledge which is essential in these times. As regards the scientific instruction it is proposed to give, I do not know the list of subjects; but I imagine it is intended to give the students some acquaintance with botany, entomology, natural science, and so on. It has become necessary, in order to produce satisfactory articles, to have a groundwork of scientific knowledge to go upon. This institution may be regarded as the generalisation of the agricultural knowledge of the world. It may be called a kind of reservoir in which everything that is known or ascertained in regard to a particular science may be stored. Those who go out of it will, like rivulets from some system of irrigation, carry into their own localities all they have learned and gained, and afford a healthy stimulus to their neighbours in the development of the riches of the soil. I do not think our Anglo-Saxon race can be said to be very observant of detail. We do not take enormous or minute pains about anything we engage in. This is more generally the case where the country is young, and where there is no pressing necessity to take advantage of every opportunity that offers itself or to carefully finish every detail of the work we have in hand. That is a characteristic which cannot be gainsaid. Here, I am confident, one lesson that will be taught will be to pay the most minute attention to the treatment of every inch of ground and to see that nothing is wanted to produce to the best degree every plant which may be grown. It is only by careful attention to detail that one can command success, and perfection is only attainable after immeasurable trouble. Genius has been defined as an infinite capacity for taking pains. Whether that is a correct definition I cannot say ; I only hope that from time to time there will issue from these buildings, and go into the larger world, batches of thoroughly equipped geniuses. In this country there are to be found none of the adverse circumstances which are encountered in plenty of places elsewhere throughout the world. I have noted that such-and-such a branch of agriculture cannot be pursued without extraneous aid from the Government. I do not believe in doles or sops from the Central Government, and from what I see has been done already by the residents of Queensland—their neat homesteads, the satisfactory exhibitions of their productions, and their general contentment with their position at the present time and with their future prospects—I cannot credit that, with the industry and the energy of the inhabitants of this colony, there is any necessity, except in peculiar circumstances, to ask or invoke Government aid. I would say that if there is one defect in Queensland it is that Nature here is almost too prodigal. In the case of individuals, as with mankind, adversity oftentimes produces success. We have instances where countries have come to the

fore under the worst conditions. I think that, if, in Queensland, the advance is in the right direction, there is a great and glorious future awaiting the residents of this country. Students, when you go out into the world it will not be to engage in warfare. You have not to subdue some unfriendly foe. Nature lays before you, for your use, her best resources. Your enterprise is indeed a peaceful one, and the furrows you will plough here or on the bosom of the rolling downs will serve to reveal rich treasures that are hidden. Your advance in time will take place on the great Western plains, and these will blossom in your wake. Corn, wine, and plenty will spring where you have trod. I have the greatest pleasure in inaugurating an institution which I believe is fraught with the utmost promise for the future development of the riches of Queensland. I believe Parliament has been wise in undertaking such a work as this; and I think the thanks of the country are due to those gentlemen who have organised and carried out this project. Above all, I congratulate those who come here, as the first recruits of the great army which is to develop the lands of the colony in the future, upon the facilities which are offered to them here to prepare for a career which is one of the most beneficial that is open to mankind. (Applause.) With these words I beg to thank you, Professor Shelton, for the opportunity you have afforded me of being here to-day; and I have the utmost pleasure, with the fullest hopes of its prosperity, in declaring this Agricultural College now open. (Cheers.)

The Exhibits of the Department of Agriculture in the Queensland International Exhibition at Bowen Park, 1897.

Amongst the most interesting and instructive exhibits at the International Exhibition must be classed those of the Queensland Agricultural Department, embracing as they do a great range of industries of importance to all classes of the community from the far North to the extreme South and West.

The amount of space allotted to the Department enabled the authorities to display to the greatest advantage the various products of the colony, and the result has been that in no other section are such facilities given to the public to examine the exhibits with comfort and profit. Everything is distinctly labelled, so that a catalogue is scarcely needed by the visitor.

Taking the various bays in order of numbers, we commence with Bays Nos. 26 and 27 in which are displayed all the paraphernalia of the Queensland Travelling Dairy, consisting of a Steam Turbine Cream Separator, "Sharple's Russian," with a capacity of 65 gallons; Cream Separator (steam turbine) "Laval," capacity 95 gallons; "Victoria" Cream Separator, capacity 35 gallons; Babcock Milk and Cream Tester, "Sharple's Russian"; "The Laval" Pasteuriser, with a capacity of 400 gallons; and "The Laval" Cream and Milk Cooler with the same capacity. There are also two additional milk-coolers—"Dobson's Patent," and "Moore's Patent." The other portions of this very complete plant consist of a concussion churn, a butter-worker, cheese vat and plant complete, a salting and cooling sink, and cheese presses. The plant, under the supervision of Mr. J. Mahon, dairy expert, has been a prime factor in instructing dairymen in various parts of the colony in the latest improved methods of conducting this important and growing branch of agriculture.

These bays, as well as all the others occupied by the Department, are well supplied with very magnificent crotons provided by Mr. L. Olsen, of Rockhampton, and with palms, ferns, and other plants from the Brisbane Botanic Gardens.

The following description of the Laval Pasteuriser and Cooler will doubtless be of interest to dairymen and others:—

The Laval Pasteuriser and Cooler—Their Use in the Dairying Industry.

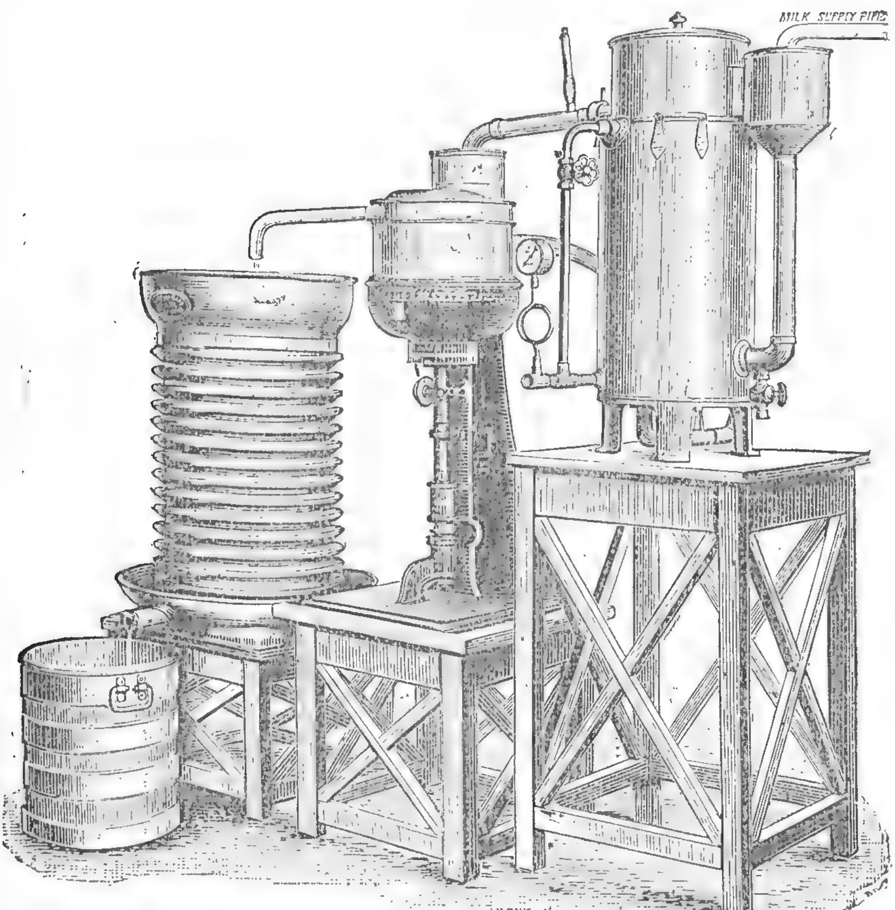
The introduction of pasteurisation in the dairying industry is one of the latest developments of the day, and has already proved to maintain the same high value as regards the wholesomeness and increased keeping qualities of the products as it has done in the brewery and other industries where it has been applied.

Pasteurisation is not, as is generally believed, a method of preserving the milk to prolong its keeping qualities. Pasteurised milk will, however, keep longer than non-pasteurised; but the main object of the method is the

destruction of organic life already in existence in the milk, so that if it is kept from the air, and no foreign substance is allowed to enter, it is perfectly pure and wholesome for human consumption.

In the Laval Pasteuriser, consisting of a double-jacketed vat, in the centre of which is an agitator kept in motion by a steam turbine under the bottom of the vat, the milk is exposed to the heat during the shortest possible time, and, leaving the apparatus at 160 degrees Fahr., is instantaneously cooled down on the cooling apparatus to nearly the same temperature as in the cooling water applied for the purpose. This apparatus, being most ingeniously designed, combines the greatest cooling surface in the smallest space, and as the fluid to be cooled flows over its outer and inner surfaces the cooling water takes up the heat, and expels at the same time the scalded taste and other gases, leaving the milk or cream sweet and fresh and beautiful to the palate. Thus, it will be understood, the pasteurisation consists of an instantaneous heating to 160 degrees Fahr., which is followed by the cooling of the milk or cream to, say, 50 degrees Fahr., the cooling being just as necessary as the heating. The latter destroys microbes, bacteria, tubercula, bacilli, &c , and the cooling checks the lower grade of spores and stops their development, removes the heated flavour, and restores the chemical composition of the milk to its original consistency. This treatment of the milk for town use is now being generally introduced in the cities of Europe, and also already adopted by a well-known milk-supplier in Brisbane, which is without doubt most beneficial to the health of the public, and especially that of the children.

Pasteurising of milk for human consumption will, we do not hesitate to say, before long be compulsory by law.



Regarding the manufacture of butter, the pasteurising has over and over again proved its beneficial influence by the increased keeping qualities, and the purer and more delicate taste it gives to the butter when properly applied, and in conjunction with a right fermentation.

The Laval Pasteurisers and Coolers are equally useful for cream as for whole milk, but it must be borne in mind that only perfectly sweet cream can with advantage be treated, for if acidity has developed it will be found afterwards to contain small specks of casein, coagulated during the heating, which will prove to be most detrimental to the value of the butter manufactured from it. The treatment of the cream is exactly the same as the whole milk. It is heated up to 156 to 160 degrees Fahr., and then cooled to 50 to 55 degrees Fahr. when the "the starter" is mixed into it. The reader will remember that the bacteria in the cream has been destroyed by the heat, and specially the lactic acid bacteria. By introducing the starter, which, if scientifically produced, should contain only lactic acid ferment or the bacteria that develops the characteristic pleasant acidity in the cream and butter, we have inoculated the agency for obtaining the right fermentation.

The starter is nothing else than milk soured in a certain way and requiring great care in preparation. A small quantity of this starter is added to the cream, which is then allowed to stand till the following day, when it is ripe and ready for churning. In order that the butter should be good, this ripening of the cream must be perfectly normal, and, since bacteria cause it, everything depends upon their nature; so, for instance, if the milk added to the cream in order to ripen it should contain some of the bacteria which produce oily, fishy, or other evil-smelling substances in milk, the cream will acquire some disagreeable odour and bad taste, consequently it is most necessary to take care that the milk employed for this particular purpose is inoculated only with bacteria producing proper ripening and an agreeable aroma.

At the same time great stress should be laid upon the exercising of the most scrupulous cleanliness in the treatment of the raw material during the whole manipulation, and all through the factory, if a regular result is to be obtained.

We next proceed to Bays Nos. 29 and 30, where we first notice a number of fine cheeses made by Mr. Mahon at the Exhibition; also, three very striking trophies, the first to catch the eye being that of the wines of Mr. Fred. Cox, of Pimpama. Mr. Cox's father was one of our oldest vignerons and wine-makers, and his son has carried on the industry with signal success, buying grapes rather than growing them, and devoting himself to the scientific production of Australian wine, notably clarets, of which the trophy under the charge of the Department mainly consists, both in glass and wood. The wool trophy was erected by the Agricultural Department, and very neatly finished off by wool exhibits of the Graziers' Butchering Company, which show to great advantage. The third trophy in these bays is devoted to the arrowroot of Mr. S. Grimes, M.L.A., neatly put up in 7-lb. bags and in 1-lb. and ½-lb. packets. The Messrs. Grimes have for many years made a specialty of their arrowroot at Rockholme, Coomera River; and in general appearance, get-up, and excellence as a food product, as well as for its purity, this arrowroot would be hard to beat. The same gentleman also has a large exhibit of chicory, both manufactured and in the root form.

Ranged along the wall, and following on Mr. Grimes's chicory exhibits, we have arrowroot again, shown by Mrs. R. Mayes, of Pimpama, another centre of the arrowroot industry. Messrs. J. Latimer and Sons, of Yatala, also have a very excellent exhibit of arrowroot in the same bay.

A unique exhibit in honey is that of Mr. Court, who shows a frame of honey in which the bees have worked Mr. Court's name in raised cells. The method of causing the bees to do this is a secret which has not been divulged.

Bays 30 and 31 deserve more than passing notice. A wheat trophy arranged by officers of the Department attracts the eye by the sensible and graceful manner in which the wheats of various kinds are arranged so as to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perfectly display them. They consist mainly of Allora Spring Wheat and bearded wheat, the whole being surmounted by a fine sheaf of bearded wheat.

Messrs. Roessler Bros.' show of pickles, jams, jellies, preserved fruits, tomato sauce, orange wine, and limejuice is a unique feature, showing as it does to what a pitch of excellence the preservation of our fruits and vegetables has been brought. The pickles especially present a most attractive appearance, and a rapid expansion of this particular industry cannot fail to eventually obviate the necessity for the imported goods.

Messrs. F. Lahey and Sons have a trophy of cornflour, for the manufacture of which farina they have special facilities on their estate at Pimpama.

No. 32 Bay is occupied by a trophy from the Queensland Cotton Manufacturing Company, Limited, Ipswich. Here we see cotton in several varieties of manufacture—such as yarns of different colours, towelling, calicos, cheese-cloth, &c.—and also in the raw state after ginning. The Lockyer Agricultural and Industrial Society, whose exhibits are also in charge of the Agricultural Department, are exhibited to great advantage in Bay 33, and consist of a trophy of very neatly constructed miniature bales of oaten, wheaten, and lucerne hay; and also of another composed of maize in the cob (most of the varieties being named), millet, sorghum, imphee, Cape barley, *Setaria germanica*, Kaffir corn, oats, lucerne seed, and Allora Spring Wheat. There are also to be seen sheaves of oats, wheat, panicum, &c., together with fine sweet potatoes, pumpkins, &c.

Yet another important society placed a very unique collection on view. This was the exhibits of the Eastern Downs Society, Warwick district. These were placed in Bay No. 34, and shown to much advantage. Twelve named varieties of wheat, rye, oats, and pearly barley in sample bottles, and also in sacks in bulk, are shown. Flour, bran, and pollard, the product of the Warwick flour-mill, are not wanting; neither is the ubiquitous maize wanting. A fine trophy of Mr. Jacob Kirchner's wines from his celebrated Assmanshausen Vineyard is conspicuous for its well got up samples. Here may also be seen honey in tins and bottles, together with beeswax, samples of coal, limestones and marbles polished and in the rough, tobacco leaf from Killarney, and a fine collection of fourteen photographs of the Warwick district, surmounted by sheaves of barley and wheat. The Warwick exhibit would be incomplete without the presence of the fine products of the Yangan Cheese Factory. The trophy consists of Cheddar cheese, made up into different sizes. This cheese has achieved a celebrity which makes it difficult for the factory to keep pace with the demand. Rennet is also shown. Mr. J. W. Dunnigan, of Killarney Apiary, and Mr. J. Carey, of the Pioneer Apiary, Killarney, also forwarded exhibits of honey neatly got up in 2-lb. and 7-lb. tins.

In Bays Nos. 36 and 37 may be seen one of the completest collections of instruments and machinery used by apiculturists that we ever remember to have seen. This collection is exhibited by Mr. H. L. Jones, of Melbonum Apiary, Redbank. It not only comprises all the appliances necessary for successfully carrying on the interesting occupation of the beekeeper, but also, by means of books dating back as far as 1691, gives us an insight into the crude methods adopted by our forefathers in the production of honey. Here we are brought to a recollection of the old country by the sight of the old familiar straw hive. Amongst the modern appliances are: A machine for making wax foundation, honey-extractors, an uncapping can, frame hives, supers, smokers, &c., &c. The exhibit is well worthy of a visit from intending or even from established beekeepers, even without reference to the fine trophy of honey got up ready for market in the wholesale and retail forms. Passing on our right a partition covered with fine stalks of maize in cob from the Agricultural College at Gatton, we are attracted by an exhibit of purely colonial produce, that of Mrs. B. Skinner, O'Connelltown, Brisbane. The excellence of the preserved meats, of the soups—turtle, bêche-de-mer, and mullagatawney—and of the jams, jellies, and preserved fruits shown in this collection are too well known in Queensland and in the other colonies to need

any commendation. The samples are tastily labelled, and are inviting to the eye. The great feature is that the whole of these appetising *mêts* are the product of Queensland's land and water.

In the same bay Messrs. Spry Bros., of Flowerdale Apiary, Rocklea, exhibit a fine trophy of honey in glass and tin, a colony of bees in a glass case, and a nucleus hive of Italian bees.

An exhibit of great interest to sugar-growers was that set out in No. 38 Bay. The canes were so displayed round the walls that each could be separately examined. They were all carefully labelled, and thus no mistake could be made in the varieties.

Special notice should be taken of the manner in which Mr. E. Cowley, of the Kamerunga State Nursery at Cairns, had arranged his exhibits. These, six in number, were displayed in narrow cedar cases, made from Cairns timber on the spot. They were very well-grown canes, and were labelled respectively Tanna, Kew, Shemei, Moore's, Lahaina, Fiji.

From the Mossman River, Messrs. Davis, Rose, and Wolfleben sent some very fine specimens of Rappoe, Meera, Striped Singapore.

From the Mowbray River, Port Douglas, Messrs. Dyason, Montgomery, and J. Moffatt sent samples of Cheribon, Meera, Elephant, New Guinea A (a very short-jointed cane which would scarcely pay a mill-owner to purchase), Lahaina, Striped Singapore, and New Guinea.

Messrs. Stewart, Pitt, and Dinnie, of Childers (Isis), contributed very fine specimens of Rappoe and Malabar cane-plant and ratoon.

A collection of manufactured sugar—white crystals, loaf, brown, and invert sugars—was shown by the Colonial Sugar Refinery Company; and in the same place Mr. D. Jones, of Goodna, had some grand samples of broom millet, eminently suited for the market.

In this section Mr. William Dunn, of Beenleigh, shows a sheaf of Red Natal Grass, a fodder which is eaten with avidity by cattle. Those who have foresight enough to provide against a severe drought or winter would do well to give this fodder plant the attention it deserves.

In Bays 39 and 40 there are glass cases containing beans and nuts of many descriptions collected by the Department of Agriculture; roots, barks, leaves, and gums of economic value—all clearly labelled and separated from each other. Here also are several varieties of pop corn, maize, wheat, barley, and oats, and a large collection of fifty-five samples of woods from the Herberton district, notably a well-polished slab of what is locally known as pinkwood. A model of an olive oil press and mill is also to be seen, and with them one of the Espartero grass-bags used in expressing the olive oil.

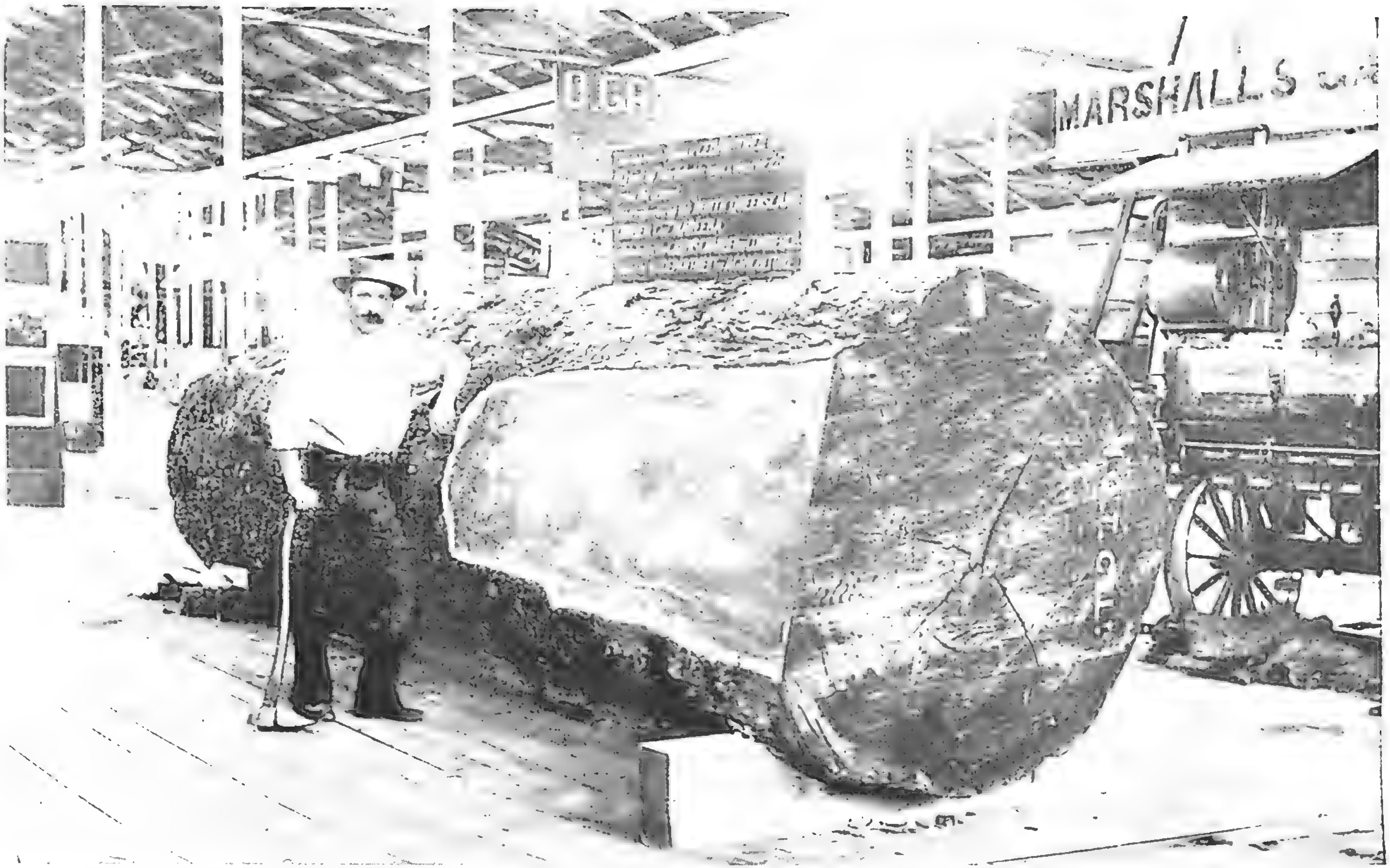
On the walls is a collection of well-executed enlarged photographs representing various phases of colonial country life by Mr. Wills, artist to the Department of Agriculture.

Amongst other subjects are:—A five-furrow plough at work, drawn by eight horses; a Queensland farm homestead; a study of pigs in the forest; an orange orchard at Gatton; the river in flood, showing a boy in charge of milk-cans being conveyed over the river by a wire attached to trees on either side; cattle at a creek crossing; sheep in a yard; loading wool on a station; and Mr. Addison Free, of Swan Creek, Warwick district, cutting wheat.

A very interesting and valuable exhibit appears in Bay 41, in the shape of several glass columns showing sections of soils from Roma, Warwick, Mackay, Johnstone River, Herbert River, Bundaberg, Emerald, Yeppoon, and Toowoomba districts. The soils show a section of six feet from the surface, thus giving a clear view of the substrata in the various localities. Each pillar is surmounted by a vase containing a sample of the products grown on the soil beneath; and as a complete chemical analysis is appended to the several soil exhibits, a more instructive object lesson could not have been presented to the farmer.

Adjoining these is a glass stand containing samples of many descriptions of wheat grown in the colony.

EXHIBIT OF THE AGRICULTURAL DEPARTMENT, INTERNATIONAL EXHIBITION—BOWEN PARK, 1897.



Cedar Log at the Exhibition, Bowen Park, 1897.

Here are also to be seen samples of cotton in process as already described. An instructive exhibit in this section is that of the Queensland Woollen Company, Ipswich.

On the wall is displayed a map of Queensland, on a scale of 10 miles to 1 inch, showing the areas suitable for wheat, maize, and sugar-cane, and also indicating the localities where experiments have been made with a view to testing the capabilities of the soil and climate for wheat-growing, by which it will be seen that West and South-west will rapidly take a foremost place in this branch of agriculture.

The Herberton Pastoral, Mining, and Agricultural Association have here an exhibit of kauri gum, which exists in some quantity in the district.

The Agricultural Department displays also a large quantity of prepared fibre and textile plants, together with an array of bottles of essential oils prepared from several varieties of eucalyptus, and a sample of oil prepared from the West Indian walnut.

It would be impossible to describe here the 425 varieties of timbers shown by the Department in Nos. 42 and 43 Bays. They comprise nearly all the Queensland varieties, and are shown both polished and in the rough. A frame of sixteen varieties of wood is shown in this section by Mr. R. A. Tills, of Redlynch, Cairns district. India-rubber (Ceara), nardoo, native asphalt, pichuri, and other native curiosities in plant life and manufactures are also shown.

Several fine enlarged photographs by Mr. Wills adorn the walls of this side of the bay, representing various aspects of the Gatton Agricultural College—Filling a silo, stooking maize, cutting maize, and ploughing at the College.

In Bay 45 a glass case of models of fruit executed by Mr. Alder, taxidermist, deserves more than passing notice. The mangoes, persimmons, tomatoes, limes, custard apples, and capsicums are wonderfully natural. Duplicates of these models of Mr. Alder's skill and taste have been sent to Europe as a proof of the magnificent prospects of the fruit-growing industry in Queensland. The plums are marvels of the art, the delicate bloom being shown in perfection. Some 200 specimens of modelled fruit, packed in neat boxes, have been placed in charge of Mr. Lyons and Mr. Randall, immigration lecturers for this colony in Ireland and England, and will serve to show that the soil and climate of Queensland are unrivalled in any other part of the world in enabling the colonists to grow to perfection every known variety of fruit.

Here also are samples of various kinds of bark used for tanning processes. They comprise green, black, and hickory wattle—*Acacia linifolia* and *Acacia aulacocarpa*.

In this section is a piece of brocade made from Queensland silk, which was much admired by Her Majesty the Queen when shown to her some time ago in England.

A variety of descriptions of cotton in the pod, manufactured cotton, prepared cornflour, wheat, Kaffir corn flour and meal complete the exhibits in this bay.

In Bay 44 are found reminders of that enthusiastic student of the Queensland fibre plants, the late Mr. A. Macpherson, of Brisbane, in the shape of a frame of Queensland fibres and paper made from them. There also are samples of cloth dyed with vegetable dyes prepared from plants grown in Queensland ; rice grown in the neighbourhood of Brisbane ,Maroochy, Wallumbilla, Cairns, and Port Douglas. In a more distant part of the section the Cairns Chamber of Commerce show coffee-trees in full bearing, and coffee in all its stages of ripe berry, parchment, silver skin, roasted, ground, and dried berry. Growing rice, cleaned rice, and paddy, cocoanuts, sugar-cane, pines, and other products of Northern Queensland are guarded by that singular denizen of the Northern scrubs, the crested cassowary. This exhibit also comprised ginger, bird's-eye chilies, bêche-de-mer, turtle-shell, dressed and polished timbers of the district, as well as a large cedar log cut from a tree giving 80 feet in length of marketable logs.

There were, besides, a number of photographs of scenery around Cairns, and an oil painting of the Barron Falls. This exhibit is, like all the others mentioned, under the control of the Department of Agriculture.

Bay 41 is very artistically fitted up. A square erection, having four imitation marble pillars at each corner, is surmounted by the Queensland coat-of-arms on a shield composed of maize in cob and grain on a field of "popped" corn. On either side are magnificent crotons, ferns, and palms interspersed with other plants, and a corn trophy and ornamental arch complete the picture.

Taking the Department's exhibit right through, it cannot but be said that a master mind directed the laying out of the section, which is full of interest and instruction not only to agriculturists but to scientists and to those who arrive in the colony with a view to the profitable investment of capital.

General Notes.

CULTIVATION OF MAIZE.

A SERIES of experiments on the cultivation of maize would prove of great value to farmers if carried out systematically on our Experimental Farms and at the Agricultural College.

In Ohio, United States, at the Experiment Station, this subject has engaged the attention of scientific agriculturists for the past nine years, and more particularly with regard to the question of deep or shallow cultivation.

A bulletin issued from the Illinois Experiment Station, as well as bulletins from other State farms, gives the return from lands cultivated at different depths, and, in the generality of cases, shallow cultivation appears to have resulted in better yields per acre than the crops from land subjected to deep cultivation. At the Illinois Station some plats were cultivated 1 inch deep, others 2 inches, others 3, and so on up to 6 inches deep. Others were not cultivated at all, but had all grass and weeds pulled out by hand, and others still were mulched 6 inches deep with straw and received no cultivation or weeding. The *Louisiana Planter* gives some of the results as follows:—

The mulched plats yielded an average of 94 bushels per acre; those uncultivated, but hand-weeded, 87 bushels; those cultivated 3 inches deep and those 6 inches deep gave the same yield, 86 bushels per acre; those cultivated 1 inch deep yielded 85 bushels; those 4 inches deep, 83 bushels; and those ploughed with a shovel-plough, 81 bushels. In previous years shallow cultivation has always given best results.

In Ohio, since 1891, the results have been uniformly in favour of the shallower cultivation; the average yield from cultivating 1½ inches deep with the spring-tooth cultivator being 6 bushels per acre greater than from cultivating 4 inches with the double shovel. Counting each season's experiments at each station as a single test, forty-five tests were reported up to the close of 1895. Of these, twenty-seven showed larger yields from shallow culture, seven were unconclusive, and eleven showed larger yields from deep culture. Of these latter, however, cultivating only 3 inches was in some cases called deep culture. There thus seems little doubt that the average yield of corn may be increased by the use of shallow-working cultivators.

TO DESTROY JOHNSON GRASS.

As plants breathe through their leaves, it follows that if the lungs of the plant are destroyed the plant itself must cease to exist. Consider Johnson grass and nut-grass as typical field pests. When the blades appear above ground, if left undisturbed they flourish vigorously on suitable soil, and will take the place eventually of whatever crop is put into the ground. But if on the appearance of the grass it is immediately attacked and cut with the hoe an inch or so below the surface, the root or nut at once begins to expend its energy in sending up fresh shoots. If these are in their turn cut down, the root will at last become too exhausted to produce fresh shoots, and will die. Now to apply the process on a large scale in a field infested with Johnson grass, the *Louisiana Planter* says:—"If you wish to kill fifty acres of Johnson grass, the ground should be ploughed in the fall with a rotary disc as deep as it will run, which will expose an abundance of roots. Turn on it your hogs during the winter, with the object of destroying the superficial roots. Early in the spring, harrow thoroughly. About the 15th August (in Queensland—March in Louisiana) begin the operation of cutting the young sprouts about 1½ or 2 inches below the surface. This cutting must be completed in seven or eight days, and the operation must be repeated until the middle of September, at which time you can plant your fifty acres in anything you desire, with the

assurance that you have effectually performed your part in every detail. You will not see any more Johnson grass on your land." The following is the method of cutting recommended:—Take a common, old-fashioned slide about 3 feet wide, and a blade of good steel to fit in a slot on the inside of each runner, so that it will easily be taken out and replaced after sharpening, which will have to be done frequently. This must be placed in such a manner as to run $1\frac{1}{2}$ or 2 inches below the surface. A seat may be arranged for the driver, whose weight would be sufficient to hold the blade to the proper depth.

THOUSAND-HEAD CABBAGE *V.* SWEDES.

A WRITER in the *Agricultural Gazette* (London) says:—"A few days ago I was over the farm of a friend who farms extensively, as he has recently added another 1,000-acre farm to a previous occupation of the same extent, making upwards of 2,000 acres in his holding, and what impressed me was the quantity of thousand-head cabbage on the farms. All the sheep, comprising about 1,500 breeding ewes and 400 tegs, were feeding more or less on this crop, and doing well on it On my remarking on this fact, he said, 'I have given up growing swedes, as it is a most expensive and uncertain crop to grow; moreover, the difficulty of obtaining hoers when required in haying and harvest is very great. I therefore now grow thousand-head cabbage in place of them. I drill them in May; when they get high enough I run the harrows across the rows and skim them about twice, and that is all the labour required.' Now contrast this with the swede crop, the uncertainty of getting plant, and all the labour of getting them set out and just at the right time. Moreover, the swede crop is very liable to total destruction from a hard frost, whereas the thousand-head cares nothing for frost; and I knew a neighbour two winters ago, when the severe frost killed everything else, sell three acres of this crop for £50 per acre for greens. I therefore think sheep-farmers in many cases would do well to reduce their swedes and replace with thousand-heads, which come in in this country (Great Britain) from about November up till end of March."

LIVE STOCK AND DEAD MEAT TRADES.

THE *Live Stock Journal* of 21st May gives the following quotations for fat stock and dead meat in the home markets:—

FAT STOCK.

Trade for fat cattle opened steadily on the 17th instant at the rates of the preceding week, but the demand became slower, prices having a downward tendency. The top price was 7d. per lb. of estimated carcass weight, sinking the offal. The highest live-weight quotation was $4\frac{1}{2}$d. per lb. on the hoof. At the Foreign Cattle Market, at Deptford, 1,520 beasts from the United States and 801 from South America were offered. The best States beasts made up to 6d. per lb. of estimated carcass weight, and best Argentines $5\frac{1}{2}$d. per lb.

The imports at Liverpool during the week comprised 751 from Baltimore, 2,352 from Boston, 2,104 from Buenos Ayres, 745 from New York, 1,175 from Portland (M.), and 249 from New Orleans.

The number of sheep and lambs offered at the Metropolitan Cattle Market, Islington, was 11,280. The top quotation was $8\frac{1}{2}$d. per lb. for sheep, and 1s. $0\frac{1}{2}$d. per lb. for lambs.

The arrivals at Liverpool during the week were 1,559 from Baltimore, 2,047 from Boston, 6,431 from Buenos Ayres, and 1,361 from New York.

DEAD MEAT.

The markets have been largely supplied, and trade has been slow for all except the choicest description, owing to the high temperature.

The quotations were:—Beef, 1s. 8d. to 4s.; ditto Scotch, short sides, 4s. to 4s. 2d.; ditto American, 2s. 2d. to 3s. 8d.; mutton, 2s. to 4s. 8d.; ditto New Zealand, 2s. 2d. to 2s. 6d.; lamb, 5s. to 5s. 8d.; ditto New Zealand, 3s. 2d. to 3s. 6d.

PRICES OF PIGS.

What may be styled a record sale of pedigree pigs was held on the 14th April last, at Elphicks (Kent), when the noted herd of Mr. E. Buss was sent to the hammer. The *Live Stock Journal*, speaking of the sale, says:—"The prices made for individual specimens were, in several cases, high, and show that the value of pedigree pigs of superior quality is such that it pays well to produce them. The Berkshire boars went at prices ranging from 25½ guineas to 11 guineas, one only going a great bargain at 8 guineas. The large White Yorkshires were in good demand, and sold at from 16½ guineas to 11 guineas. The sixty-eight lots made an average of £6 7s. 5d. Forty-one of these were young pigs farrowed since 1st December, 1896 (*i.e.*, less than four months old)."

FRUIT EXPORT—CAPE OF GOOD HOPE.

The value of the fruit exported during the month of March, 1897, from the Cape of Good Hope, as shown in a table published in the *Agricultural Journal* of the Cape of Good Hope, was—Grapes, £2,365 14s. 6d.; apples, £5; pears, £74 10s.; a total of £2,445 4s. 6d.

GRAPES FOR ENGLISH MARKETS.

The possibility of landing grapes upon the English market in good condition has long been a question (says the *Melbourne Age*) of doubt and the object of experiment. Several trial shipments have been made through Messrs. P. R. Baker and Co. this season by fruit-growers from the Goulbourn Valley, Heathcote, and Bendigo districts, the first of which comprised three small consignments of the Doradilla, Waltham Cross, Pink Lady's Finger, and Raisin de Dame varieties, and were despatched by the "Ormuz" on 13th March last. The account sales are now to hand, and seem to point to the fact that the Doradilla, Waltham Cross, and Raisin de Dame varieties, when properly packed, may be shipped with success. Prices realised by one shipper were 17s. per case for Doradilla and 15s. for the two other sorts named, while another grower realised a fraction under 20s. per case for the whole shipment of Doradillas. The Pink Lady's Finger variety was a failure. These grapes were packed in cork-dust and put up in shallow trays, two of which were nailed together, and occupied about the same measurement as a bushel case, and were shipped in the ordinary cool chamber. By way of comparison, it should be noted that the value of the Doradilla grapes at the time of the shipment was made was from 2s. to 3s. per case.

The grapes shipped from Sydney to London this season realised from 6s. to 7s. per case, and are reported to have arrived in good condition.

AMERICAN VINES.

By the courtesy of the Vice-Consul for the French Republic (the Hon. E. B. Forrest, M.L.C.), we have received a letter from the proprietor of the Alénya Vineyard and Nursery, near Elne (Pyrénées-Orientales), describing some American vines particularly adapted to calcareous and rocky soils. M. Rességuier, the proprietor in question, quotes, in support of the claims of the *Berlandieri* vine of Texas to immunity from disease (including the dreaded phylloxera), the opinion of M. Pierre Viala, Professor of Viticulture at the National Agronomical Institute, on the rehabilitation of the vineyards of the Department of Maine-et-Loire, expressed at the conference at Angers in October, 1890. M. Viala then expressed himself as follows:—"The American vines, grafted or not, die on all the calcareous soils. To graft them on well-known stocks would be to expose oneself to a certain checkmate. It will be better to wait." Subsequently M. Viala visited Texas, and thoroughly went into the question, and on his return he said:—"The *Berlandieris*, which I recommended on my return from America, where I had seen them green and vigorous in the chalk lands of Texas, will enable us to renovate our vineyards

on many chalk and marl lands, where all other stocks fail." M. Rességuier, who is an expert viticulturist and a member of many agricultural and viticultural societies in France, says:—

For fertile, rich, heavy, deep soils, which are not too calcareous, I recommend *Riparia Portalis* or Gloire de Montpellier. It is the best of *Ripariæ* for deep soils, and is far superior to any other for marly soils. For gravelly, light, poor soils of little depth, the *V. rupestris* should be planted. M. Viala affirms that in Texas the *Riparias* succeed marvellously in dry country, exposed to the burning rays of the sun, and yet they can withstand a temperature of 28 degrees centigrade below zero, without being affected by the cold.

There are many varieties of *Rupestris*. The best are *R. Martin* and *R. Le Lot*. Representing resistance or absolute immunity from disease by 20, and vigour of growth by 20, the results are—

Rupestris Martin: Resistance, 19·50; vigour, 19.

The *R. Le Lot* thrives in the worst of soils. Plants the size of a knitting-needle when planted out attain in two years a diameter of over an inch.

One proof of their value is in the price obtained for the wine produced from them at the public auction sales of the wines of the Hospices de Beaune (vintage, 1892), which exceeded that of the old vineyards ruined by phylloxera.

The advantages of the *Berlandieri* are stated to be—

1. The vine can withstand great heat, excessive drought, and excessive cold.
2. It is the only stock which flourishes in the most calcareous and gravelly soils.
3. It is easy to graft.
4. It increases rapidly in size, and there is no nodulation at the point of union.
5. It fruits more abundantly than any other known vine.
6. It resists successfully the phylloxera.

QUEENSLAND AGRICULTURAL COLLEGE.

WRITING on the subject of the Queensland Agricultural College, the *Tropical Agriculturist* (Colombo) says:—

"In any undertaking—and particularly in an institution of this nature—it is most important that there should be no mere temporary makeshift measures, no impediments arising from a grudging of funds, and that ample facilities should be given for allowing the influence of agricultural education to spread freely among those interested. We note that special provisions are made for the carrying out of practical experiments in the field. Such an admirable scheme is what might be expected when there is a qualified head to foster the cause of agricultural education, such as the Queensland Minister for Agriculture. Without the influence of an expert, and where it is left to the mercy of officers with no special qualifications, the cause is doomed to failure. Even in India there are directors of land records and agriculture, who are highly trained agricultural officers, but in Ceylon—well, things are different.

"We heartily wish the Queensland College a prosperous career, and that abundant success may crown its laudable efforts to improve the agriculture of that rich and extensive colony."

WHEAT CROPS.

THE world's visible supply of wheat on 1st June, according to *Beerbohm*, was only 11,142,000 quarters, the smallest quantity recorded at that date for a great number of years. In a table giving the figures from 1888 onwards, there is no such low total, and it is necessary to go back to 1890 to find one as low as 12,000,000 quarters. Now, the average price in England this year on 1st June was 28s. 2d. per quarter, whereas in 1892, when the world's visible supply was 17,000,000 quarters, it was 31s. 2d.; and in 1891, with a visible

supply of 15,070,000 quarters, the average was 40s. 1d. Seeing that the coming world's harvest cannot be a good one, and that it will be about a month later than it is in some seasons, the current average price must be regarded as anomalous.

Reports from Continental countries as to crop prospects are of a chequered character. The improvement in France is not great at present, the wheat crop especially being backward and stunted. In Spain, where harvest has begun, the crops are excellent. The latest reports from Italy show disappointment, rust being complained of as common. In Germany, Holland, and Austria-Hungary the outlook is tolerably satisfactory, though floods and rust are mentioned in the latest reports from the country last named. Great damage has been done by floods in Roumania and Bulgaria; but in Russia the rains appear to have done good on the whole, though excessive in some districts.

Commenting on the official estimates of the acreage and condition of the French wheat crop, the *Journal d'Agriculture Pratique* says that, unless the crop improves, it can scarcely yield more than 100,000,000 hectolitres, or 34,375,000 quarters, which may be compared with nearly 41,000,000 quarters (by measure) grown in 1896. As a year's consumption in France is over 43,000,000 quarters, the probability is that imports will be on a considerable scale in the next cereal year. During the last three years the crops have been so large that very little foreign wheat was needed.

MILKING MACHINES.

A REPORT has been made by the judges appointed by the Highland and Agricultural Society of Scotland to examine the milking machines competing for a prize of £50, offered in connection with the Glasgow Show. The only competitors were Mr. W. Murchland, of Kilmarnock, and the Thistle Mechanical Milking Machine Company, of Glasgow; the former having entered one and the latter two machines. The judges visited farms at which the machines respectively have been in use for some time, saw them at work, ascertained the effect upon the cows, and compared the keeping quality of the milk obtained by them with milk drawn by hand. In awarding the prize to the Murchland machine, the judges state that they inspected it on three farms, on two of which it has been worked since 1891. It was found in each case to milk efficiently and speedily, only four to six minutes per cow being occupied. It seemed to cause no injury or even discomfort to the cows, and the keeping quality of the milk proved satisfactory. The apparatus is simple, and so easy to work that a ½-horse power oil-engine on one farm supplies the power for milking ten cows at a time quite easily, while one man with an ordinary force pump worked the machine before the oil-engine was obtained. This machine draws the milk by continuous suction, without any apparent pulsatory movement, to effect which more complicated mechanism, which is a disadvantage, appears to be necessary.

AGRICULTURAL AND HORTICULTURAL SHOWS.

THE Editor will be glad if the secretaries of Agricultural and other Societies will, as early as possible after the fixture of their respective shows, notify him of the date, and also of any change in date which may have been decided on.

SHOW FIXTURES.

National Agricultural and Industrial Association of Queensland, Brisbane	10 August
Royal Agricultural Society, Toowoomba	4 August.

The Markets.

AVERAGE MONTHLY MARKET RATES (TOP PRICES) IN BRISBANE FROM 1ST JULY, 1896, TO 30TH JUNE, 1897.

Article.	—	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bacon	lb.	0 0 6¼	0 0 6	0 0 6	0 0 6	0 0 6	0 0 6	0 0 6	0 0 6⅓	0 0 6¼	0 0 6¼	0 0 6½	0 0 6¼
Bran	ton	5 17 6	5 13 0	4 16 3	3 19 0	4 3 9	3 7 6	3 4 0	3 3 9	3 7 6	4 8 9	5 10 0	5 12 6
Butter, First	lb.	0 1 3	0 1 4¼	0 1 4⅕	0 1 3⅘	0 1 2¾	0 0 9⅗	0 0 8	0 0 8¼	0 0 9¼	0 0 10½	0 1 3⅓	0 1 $4\frac{1}{16}$
Butter, Second	,,	0 0 10⅓	0 0 11	0 0 11⅗	0 0 10⅘	0 0 9¼	0 0 5¼	0 0 4⅜	0 0 5⅓	0 0 $5\frac{1}{16}$	0 0 6	0 0 9⅜	0 0 10⅜
Chaff, Mixed	ton	5 0 7½	4 10 6	4 4 4½	4 3 0	4 3 1½	4 3 9	4 6 0	4 0 7½	4 1 3	4 6 10½	5 10 0	5 7 6
Chaff, Oaten	,,	6 1 3	5 0 0	4 13 9	4 12 0	4 18 9	4 13 9	5 0 0	5 0 0	5 2 6	5 6 10½	6 0 0	5 18 9
Chaff, Lucerne	,,	4 10 0	3 17 0	3 6 10½	3 10 6	3 15 0	3 10 0	3 6 0	3 2 6	3 6 3	4 4 4½	5 10 0	5 8 9
Chaff, Wheaten	,,	4 5 0	3 16 0	3 16 3	3 10 0	3 6 3	3 5 0	3 9 0	3 10 0	3 8 1½	3 6 3	4 5 0	3 18 9
Cheese	lb.	0 0 6¼	0 0 7⅖	0 0 7¼	0 0 7⅗	0 0 8¼	0 0 7⅗	0 0 6¼	0 0 5½	0 0 5½	0 0 5⅝	0 0 6⅓	0 0 6½
Flour	ton	13 0 0	13 2 0	13 2 6	13 18 0	17 0 0	16 17 6	17 3 0	16 7 6	16 0 0	16 0 0	16 0 0	15 8 9
Hay, Oaten	,,	5 7 6	None	4 0 0	4 4 0	4 2 6	3 3 9	3 18 0	3 17 6	4 0 0	4 0 0	4 10 0	4 17 6
Hay, Lucerne	,,	3 17 6	3 6 0	3 0 0	3 9 6	3 5 7½	2 3 2	2 4 0	2 1 3	2 7 6	3 5 0	4 17 6	4 8 9
Honey	lb.	0 0 2	0 0 2	0 0 2⅜	0 0 2½	0 0 2¼	0 0 2	0 0 2	0 0 2	0 0 2⅓	0 0 2	0 0 2½	0 0 2½
Japan Rice—Bond	ton	12 16 8	13 2 0	13 10 0	13 8 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 17 6
Maize	bus.	0 2 4¾	0 2 0⅖	0 2 0	0 2 1⅖	0 2 5¾	0 1 11¼	0 1 8⅜	0 1 11⅜	0 2 1¾	0 2 4	0 3 3	0 2 11¼
Oats	,,	0 3 10	0 3 11⅗	0 4 2¼	0 4 0	0 4 0	0 4 0	0 4 0	0 4 0	0 3 11¼	0 4 0	0 3 7½	0 4 0
Pollard	ton	6 2 6	5 15 6	4 18 9	4 0 0	4 5 0	3 12 6	3 9 6	3 10 0	3 11 3	4 12 6	5 17 6	6 3 9
Potatoes	,,	6 0 7½	6 1 6	5 16 10½	7 13 0	7 18 9	5 10 0	4 4 0	3 8 9	3 16 3	4 11 4½	6 0 0	5 18 9
Potatoes, Sweet	,,	1 18 9	2 1 0	2 8 9	3 1 0	3 8 9	2 13 9	2 2 6	3 0 0	1 18 9	1 17 6	2 1 3	2 2 6
Pumpkins	,,	2 6 3	1 11 2	1 16 3	3 12 6	3 12 6	3 3 9	2 5 0	2 6 3	2 5 0	2 17 6	3 3 9	2 8 9
Sugar, White	,,	16 17 6	16 10 0	16 10 0	16 2 0	16 2 6	16 5 0	16 10 0	16 17 6	17 0 0	17 0 0	16 17 6	17 0 0
Sugar, Yellow	,,	14 1 3	14 6 0	14 5 0	14 2 0	14 3 9	13 6 3	13 16 0	14 12 6	13 17 6	14 2 6	14 10 0	14 5 0
Sugar, Ration...	,,	12 15 0	12 10 0	12 15 0	12 8 0	12 2 6	11 15 0	12 2 0	12 12 6	12 5 0	12 2 6	12 15 0	12 2 6
Wheat	bus.	0 4 10	0 4 9⅘	0 4 8¾	0 4 8⅕	0 5 6	0 5 0	0 5 2	0 4 11¼	0 5 0	0 4 9	0 5 0	0 5 0
Onions	cwt.	0 9 9	0 11 4¼	0 12 5¼	0 16 6	0 16 0¾	0 7 6	0 7 10⅓	0 8 6	0 8 6	0 7 11¼	0 9 0	0 10 0
Hams	lb.	0 0 9¼	0 0 8⅗	0 0 8⅕	0 0 8⅘	0 0 9⅛	0 0 9	0 0 8⅜	0 0 8⅝	0 0 8⅝	0 0 8⅕	0 0 8½	0 0 8⅝
Eggs	doz.	0 0 11	0 0 6⅘	0 0 5⅝	0 0 6	0 0 7	0 0 6⅜	0 0 8¾	0 0 10⅝	0 0 8⅜	0 0 11⅞	0 1 5	0 1 4⅞
Fowls	pair	0 3 10½	0 3 10	0 4 0¼	0 3 9	0 4 3¾	0 3 11	0 3 6⅗	0 2 10½	0 3 1⅓	0 3 0	0 2 9¾	0 3 5¼
Geese	,,	0 5 6	0 6 1	0 5 9	0 5 4⅘	0 6 5¼	0 6 3	0 5 9¼	0 5 9	0 5 2¼	0 5 0¾	0 4 9	0 5 1½
Ducks, English	,,	0 3 4½	0 3 6⅓	0 3 7⅓	0 3 10⅕	0 3 8¼	0 3 8¼	0 3 3⅜	0 2 8¼	0 2 10⅓	0 2 10⅓	0 2 4½	0 2 9
Ducks, Muscovy	,,	0 4 4⅕	0 4 6½	0 5 1⅓	0 5 0	0 5 3¾	0 5 6	0 4 10⅔	0 3 6¾	0 3 9¾	0 3 7⅓	0 3 2¼	0 3 5¼
Turkeys (Hens)	,,	0 6 7½	0 7 1	0 7 7½	0 7 4⅘	0 8 1½	0 7 9	0 6 8⅖	0 6 2¼	0 6 2¼	0 5 6¾	0 4 8¼	0 5 5¼
Turkeys (Gobblers)	,,	0 13 4½	0 12 3	0 13 9	0 15 0	0 15 10½	0 16 9	0 14 10	0 12 1⅓	0 12 7½	0 10 7½	0 9 1½	0 9 7½

Farm and Garden Notes for August.

Activity in the field during this and the following month will be richly repaid at harvest time. Potatoes, yams, arrowroot, ginger, and sugar-cane may now be planted. Maize for an early crop should be sown as well as pumpkins. Maize-growers would do well to read the article published in this issue on the comparative results of deep and shallow cultivation of this crop. Sow lucerne, clover, and Swede turnips. Weeds will shortly begin to assert themselves, and all growing crops should be kept clean.

The Kitchen Garden will require to be well attended to, and all plants affected with aphis destroyed. Plant out asparagus, rhubarb, and Jerusalem artichokes in well-prepared beds. A large variety of vegetables may now be sown—such as cabbage, beet-root, lettuce, radish, parsnip, spinach, rhubarb, sea-kale, and asparagus—in properly prepared beds. In warm, sheltered situations, towards the end of the month, sowings may be made of melons, cucumbers, tomatoes, and vegetable marrow. Tobacco may be sown during August.

In the Flower Garden all such work as trimming and repairing lawns, the digging of beds, pruning, and planting should be completed. Plant out antirrhinums, pansies, hollyhocks, verbenas, petunias, &c., which were lately sown. Sow zinnias, amaranthus, balsam, chrysanthemum tricolor, marigolds, cosmus, coxcombs, phloxes, sweet peas, lupins, &c. Plant gladiolus, tuberoses, amaryllis, pancratium, ismene, crinums, belladonna, lily, and other bulbs. Dahlias would, however, be more advantaged by placing them in some warm, moist spot, when they would start gently and be ready for planting out a month or two later.

Mr. H. A. Tardent, manager of Westbrook Experimental Farm, writes under date 15th July:—"Since the drought broke up, the whole of the Downs has had from 1 to 2 inches of rain, according to locality. This has been sufficient to give a fair start to the wheat and other cereals, which everywhere look beautiful. But if more rain does not come ere long the wheat will, in many places—especially on newly broken ground—wither away and die out. In the neighbourhood of Roma the rainfall was nearly 4 inches, and on all sides the farms look green and prosperous."

Field and Garden Notes for Tropical Queensland.

FIELD.

Owing principally to recent wet weather, the cutting of sugar-cane has not yet been commenced. The crop of cane should be a good one, the season having been very favourable for the growth of cane.

The rice crop, which has been an excellent one, has now been harvested. There will probably be an output of 200 tons of paddy from the Northern districts.

Coffee has now been nearly all gathered on the various farms. The output will probably not reach 5 tons of clean coffee. A considerable quantity of trees will come into bearing during next season. Half a ton per acre fit for market is confidently expected from some areas.

GARDEN.

French beans may still be planted with expectations of a good crop. A few peas might be planted, but it is rather late. Potatoes will not thrive if planted during July or August on the coast, but tablelanders may yet plant for a time. This has been a remarkably good season for the kitchen gardener.

Orchard Notes for August.

By A. H. BENSON.

The planting of all deciduous trees should be completed by the end of this month in all parts of the colony, but evergreen trees can be transplanted during seasonable moist weather at any time of the year if the operation is carefully carried out. When set out, the young trees must be cut hard back to a height that in no case should exceed 2 feet from the ground, and in warm dry districts half of this height is to be preferred. Cutting back at planting insures a strong and vigorous young growth, whereas by neglecting to cut back hard at planting the future growth, vigour, and symmetry of the tree are greatly impaired if not completely spoilt. The pruning of all deciduous trees must also have been completed; and all citrus fruit trees from which the fruits have or should have been gathered should be gone over carefully, all dead and badly diseased wood should be removed, and any crossing or superfluous branches, or water sprouts, should be cut away. When the trees are badly attacked by scale this pruning should be severe, in order that the remedies used for dealing with these pests may have a fair chance, as when the top of a citrus tree is allowed to grow like a mat it is impossible to get the spraying material used on to the parts where it is most wanted. Spraying should be systematically carried out in every orchard in the colony during this and the preceding month, and in the case of fungus diseases on deciduous trees during the following month as well. Spraying is just as essential an operation as the gathering of the fruit; and no fruit-grower who wishes to make fruit-growing a success can afford to neglect it, as it is impossible to breed disease in fruit trees and to grow fruit profitably at one and the same time. A full description of the operation of spraying and of the most approved remedies was published some months ago in pamphlet form by the Department of Agriculture, so that any grower who has not received a copy and who desires to obtain the necessary information may obtain it by writing to the Department. After pruning and spraying, the orchard should be ploughed; so that all weeds and trash can be buried, and also that the land that has been trodden down firm shall be broken up. Use a short American plough that will take a wide furrow and turn it right over. The depth at which to plough will depend on the treatment the orchard has previously received and on the nature of the soil. If the soil is shallow, or if the land has never been worked, then the ploughing must be shallow or the roots will be badly injured; but where there is plenty of soil and a perfect sub-drainage, then the ploughing can be from 4 to 6 inches in depth (provided the land has been previously cultivated) without any injury to the trees. In fact, in such soils surface roots are not required, and the trees stand dry weather best when deeply rooted. Grape vines attacked with black spot, where they have not been dressed with sulphate of iron previously, should be treated during the earlier part of the month; and this treatment should be followed in the earlier parts of the colony with a spray of Bordeaux mixture towards the end of the month or just before the buds burst into leaf.

Quick-acting artificial manures, such as sulphate of ammonia, sulphate of potash, or superphosphate, can be applied during the month, but care should be taken not to apply too large a quantity at once, as owing to their extreme solubility a considerable portion of them is apt to be washed out and lost by heavy rains. In conclusion, one more word about spraying, and that is: Do your

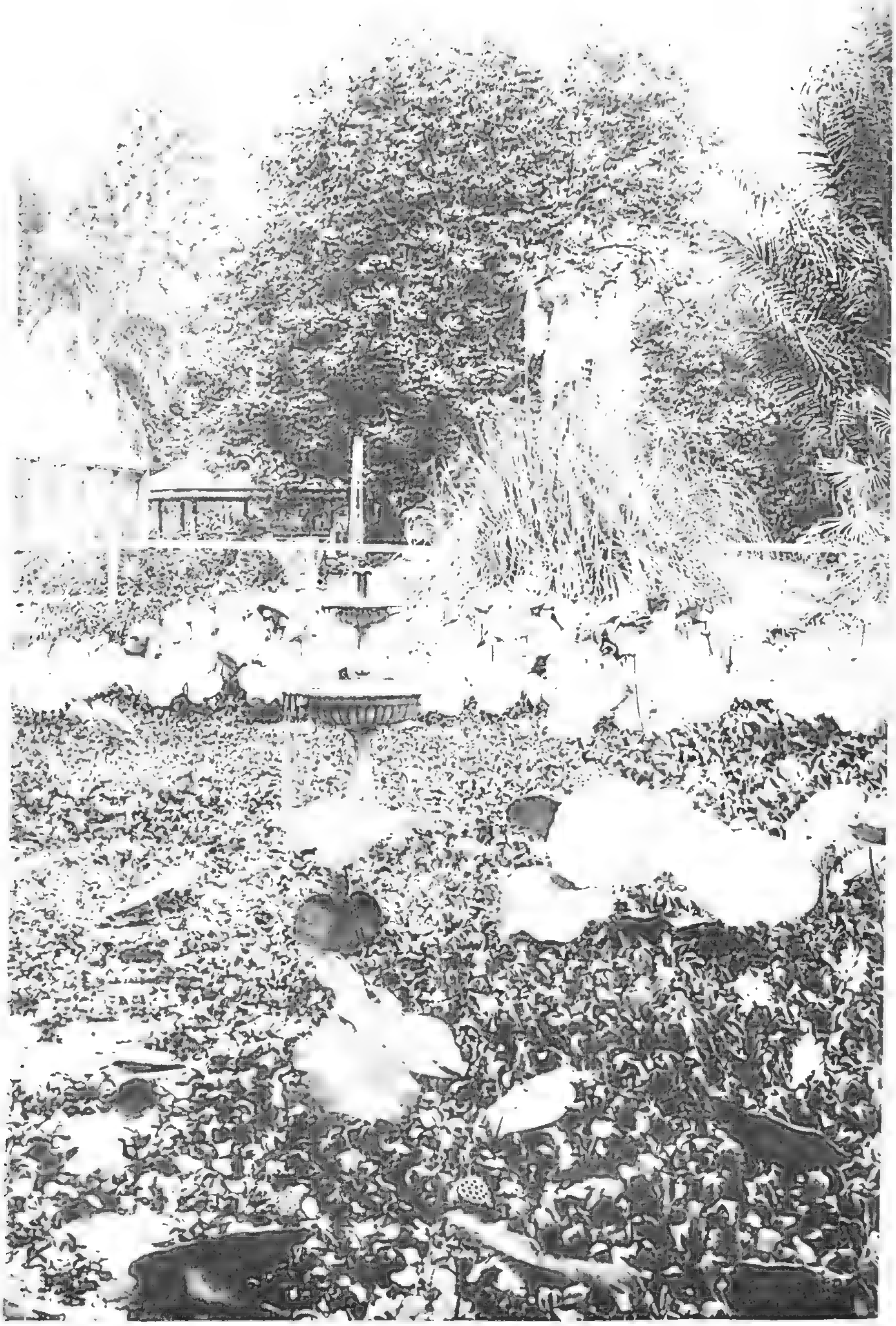
utmost to stamp out diseases in new districts as soon as ever they make their appearance. Don't consider any disease too trivial, and that it can be well let alone to a more convenient time, as the more convenient time will not come, but the disease will flourish and spread rapidly, so that what might have been checked, if not eradicated, by half-an-hour's work will now take the grower all he knows to get the better of it. In spraying, whether for insects or fungi, a knowledge of the pests to be treated, combined with carefulness and promptitude, are the essentials of success.

In notes of this kind it is impossible that they apply equally to every part of the colony, but they will be found to be about an average. Very early districts will sometimes require the notes of a month later, and very late districts those of a month earlier; but this will right itself when a year's notes have been written.

ORANGES.

JAMAICA produces some kinds of oranges which, under the name of "Paradise fruits," and "grape fruits" are sold at wonderful prices in New York. Last year the United States absorbed £20,000 worth of the Jamaica "grape-fruit" oranges.

Two barrels were sold in New York at £5 each, and seven barrels of similar fruit sold in Philadelphia for £5 10s. per barrel. These oranges would be retailed at about a dollar a piece (4s. 2d.). The most valuable orange in Australia has never approached such a value as this. The properties of the "grape fruit" appear to be medicinal, as a tonic and febrifuge. The growers in Jamaica now propose to try the British markets, as the United States Government have increased the duty on imported oranges.



WATER HYACINTH (Brisbane Botanical Gardens).

Registered at the General Post Office as a Newspaper.]

THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. A. J. THYNNE, M.L.C.,

SECRETARY FOR AGRICULTURE.

VOL. I. PART 3.

SEPTEMBER, 1897.

By Authority:

BRISBANE: EDMUND GREGORY, GOVERNMENT PRINTER.

1897.

CONTENTS.

CONTENTS.

Mutual Aid and Co-operation in Agriculture.

Although the following paper on the above subject was read nearly a year ago, at the Eighth Annual Congress of the Agricultural Bureau of South Australia, by Dr. F. Ockley, representative of the Penola Branch, yet his remarks are so applicable to us in Queensland, and fit in so well with those made at the opening of the Queensland Agricultural College by the Hon. A. J. Thynne, Minister for Agriculture, that we reproduce it for the benefit of those of our readers who may not have had an opportunity of seeing the South Australian *Journal of the Bureau of Agriculture:*—

Dr. Ockley said: I have endeavoured to collect for the Congress, as concisely as possible, what has taken place during the last few years in England and on the Continent in regard to co-operation. Co-operation in agriculture in England has so far not made any great strides. The agricultural community have not grasped the idea of the same beneficial expediency that the manufacturing community in the North of England has been enabled to grasp during the last forty years. But I believe the time is coming when the farmers of England will find it to their advantage to co-operate to sell their produce in the best market. Englishmen are conservative. They have stuck to their old individualisms, and one man is continually competing with his neighbour, and even destroying the markets at his very door. (Applause.) I will just lay before you these few notes which I have gathered together from time to time.

When an industry is prosperous, indvidualism is natural enough to men whose living can be assured by their own efforts, but, when trials arise, the utility of association is immediately felt, for it alone can give to individuals the power which is indispensable for a successful struggle against financial difficulty.

Individuals are able to do very little to advance or improve society, but by combining for the purpose much can be accomplished. Mr. Mills has said that almost all the advantages of man over the inferior animals arises from his power of acting in combination with his fellows, and of accomplishing by the united efforts of numbers what could not be attained by the detached efforts of individuals.

The secret of social development is to be found in co-operation; and the great question of improved economical and social life can only receive a satisfactory solution through its means. To effect good on a large scale, men must combine their efforts; this combination on the part of the consumers has been the means of providing the great mass of the toiling population of England with cheap and wholesome food and clothing, making them healthy, happy, and prosperous.

When the struggling producers of Australia combine as loyally together for the disposal of their produce as the pioneer co-operators of England did for the purchase of their necessities, it will be one great means of restoring the prosperity and happiness of the colonies, and on a surer, firmer basis than land or other booms.

Co-operation may be described as a joint-stock individualism, having an undoubted tendency to breed self-dependence and exertion, especially in production, each vieing with the other in the production of the very best. The importance of co-operation in England, Holland, and Denmark is well known, while in Germany, and especially on the Rhine, the co-operative societies are already an important factor of industrial life.

In Germany the Raiffersen System of Co-operative Agricultural Credit Association has been established to prevent the small landowners from falling into the hands of the money-lender. They grant no money to minors or spendthrifts, but only for the purposes of agricultural benefit, or by means of which the condition of its members is ameliorated. When the borrower receives a loan, the society sees that the proceeds are wholly expended for the purposes for which advances are made.

The rural loan banks of Northern Italy are also established on the same system since 1883. The large amounts invested and the large annual turnover of the British societies has been fully entered into lately by the delegates sent out by them. As showing the strides co-operation is making in Europe—the productive and consumers' associations on the Middle Rhine showed a few years ago a yearly expenditure of

£18,437,500, and the sum of £3,675,000 was granted during the year in loans. By this means, in Germany, it is stated that in thousands of village communities in which no sort of chemical manure or rational fodder was ever known both have become of every-day use to a quite unforeseen extent.

All sorts of labour-saving implements and agricultural machinery and better breeds of cattle are bought through the associations, and various arrangements for improving the quality of the produce begin to be introduced. Unions for the sale of agricultural produce are also formed, as well as for permanent improvement of the land.

The co-operation or mutual aid that can be rendered to one another by an agricultural or horticultural community is almost unexhaustive. Mutual aid in all possible circumstances of village life is part of the routine life in France.

Everywhere we meet under different names with the *charroi—i.e.*, the free aid of neighbours for taking in a crop, vintage, or for the building of a house; and everywhere the commoners associate for all sorts of work. This will perhaps be better illustrated by extracts from letters on this subject which I copy from an article on "Mutual Aid amongst Modern Men," by Prince Kropolkin, in the *Nineteenth Century*, and written to him by an aged man who for years has been mayor of his commune (Ariege, in the south of France). The facts he mentions are known to him from long years of personal observation, and on the whole they depict quite a little world of village life. "In several communes in our neighbourhood the old custom of *l'emprunt** is in vigour. When many hands are required in a *mètairie*† for rapidly making some work—dig out potatoes or mow grass—the youth of the neighbourhood is convoked; young men and maidens come in numbers, make it gaily and for *nothing*, and in the evening, after a gay meal, they dance.

"In the same communes, when a girl is going to marry, the girls of the neighbourhood come to aid in serving the dowry. In the hamlet of C. a threshing-machine has been bought in common by several householders, the fifteen or twenty persons required to serve the machine being supplied by all the families. Three other threshing-machines have been bought, and are rented out by their owners; but the work is performed by outside helpers invited in the usual way."

It is, however, Russia which offers perhaps the best field for the study of co-operation under an infinite variety of aspects. It is here a natural growth, an inheritance from the middle ages; and while a formally established co-operative society would have to cope with many legal difficulties and official suspicion, the informal co-operation—the *artel*—makes the very substance of Russian peasant life.

In Russia the peasants combine for mutual aid—*e.g.*, a plough is bought by the community, experimented upon on a portion of the communal land, and the necessary improvement indicated to the makers, whom the communes often aid in starting the manufacture of cheap ploughs as a village industry. In the district of Moscow, where 1,500 ploughs were bought by the peasants during the last five years, the impulse came from the communes which rented lands as a body for the special purpose of improved culture. In the north-east (Vyatka) small associations of peasants who travel with their winnowing-machines (manufactured as a village industry in one of the iron districts) have spread the use of such machines in the neighbouring Governments. The very widespread use of threshing-machines in Samara, Saratoo, and Kherson is due to the peasant associations, which can afford to buy a costly engine, while individual peasants could not.

It has been adduced in many economic treatises that the village community was doomed to disappear when the three-field system had to be substituted by the rotation of crop system. We see in Russia many village communities taking the initiative of introducing the rotation of crops. Before accepting it the peasants usually set apart a portion of the communal fields for an experiment in artificial meadows, and the commune buys the seed. If the experiment proves a success, they find no difficulty whatever in redividing their fields, so as to suit the five or six fields system.

Permanent improvements—as drainage and irrigation—are of frequent occurrence. For instance, in three districts in Moscow—all three industrial to a great extent—drainage works have been accomplished during the last ten years on a large scale in no less than 180 to 200 different villages—the commoners working themselves with the spade. At another extremity of Russia, in the dry steppes of Novouzen, over a thousand dams for ponds were built, and several hundreds of deep wells were sunk by the communes; while in a wealthy German colony of the south-east, the commoners worked, men and women alike, for five weeks in succession to erect a dam two miles long for irrigation purposes. What could isolated men do in that struggle against the dry climate?

* Borrowing or making use of. † Farm.

In Australia no industry is more prosperous than dairying, and a few years past none met with more neglect, and grass was often grudged for the old milker. This industry has been created and fostered by co-operation; it employs a large amount of labour, and the proceeds are divided amongst the many. It is sometimes feared that the market can be glutted; but let the co-operate producers here loyally co-operate with the co-operate consumers in England—they can take *all the good butter* Australia can produce, and return you substantial bonus in reduced commission and charges. The same applies to fruit and many other commodities. Have your dealings as direct as possible with the consumer, be true to yourselves, and it will follow, as night follows day, you will be true to your customers. The co-operators of England want all you can produce—not a little, but all—but they want it good, and they can pay for it, and will have it. Do not ask the Government to do this for you; do it yourselves. Co-operate. Governments are expensive traders; if it does not appear in the charges it must come out of the taxes, and it is not fair that taxes should be used for these purposes. I have endeavoured to lay before you what your competitors are doing to place their produce in the world's market; let the producers of Australia charge these markets with the produce of Britain's sons—let Briton feed Briton, and the grand old Union Jack will remain mistress of the world.

Mr. G. Stone (Port Germein Branch) said: We can safely conclude that the producers generally are about the only class who are not united. There is no reason why they should be divided. (Hear, hear.) Farmers should be in a position to combine for the sale of their produce and the purchase of their goods. I heartily agree with Dr. Ockley when he says, Do not ask the Government to do everything for you; do it yourselves. (Hear, hear.) The present Government are certainly making an effort to assist the producers to find markets for their produce. But personally I fear for the ultimate success of their efforts. Farmers should combine amongst themselves and go in for their own undertakings.

The General Secretary (Mr. A. Molineux) said: If they will only co-operate, I believe the people in our hills districts would very considerably benefit themselves, besides benefiting the colony. (Applause.) They raise fruit of the very best quality in these hills, bring it to the city, and sell it through middlemen. They have to take what the middlemen will give them, and they cannot sell more than the middlemen will take from them. They cannot hawk their produce about from place to place because they have not the time, and it would not pay them to do so; their time is wanted on their orchards and gardens, to cultivate or to load up produce again for the city. Supposing now that the people in a certain district were to co-operate, they would first establish stores in the city or in certain localities where they would have managers who would tell them what produce was required from day to day—that is, as regards fresh material, and as regards the surplus produce that would be manufactured at their own factories in the hills. An enormous quantity of produce could be manufactured either by evaporation, dried by the sun's heat, or treated in other ways, and turned into jams, jellies, marmalade, crystallised fruit, and so on. I have seen crystallised fruit and jams, jellies, and marmalade manufactured here far superior to anything we import from foreign countries. You will find any quantity of imported produce stacked in the windows of our grocers' establishments, and even pickles. If the producers in the hills would work together they might supply the city with all sorts of produce that is required, and they could export a great deal of their manufactured stuff, especially to Western Australia. (Applause.) I do not see why we should import from Europe stuff which we grow upon our own lands and much of which we really waste. (Applause.) If co-operation amongst the gardeners and fruit-growers in the hills districts were adopted, instead of their being confined to a few lines they could produce all the year round; and instead of each one manufacturing and dealing with his own surplus produce he could send it to the factory where skilled labour would turn out a far superior article. And prices for produce would be lower to the consumer all the year round; there would be a very superior product, while the profits derived from a standing and regular supply cannot be realised. (Applause.) Sometimes a grower brings down a load of stuff, really good produce, and cannot sell it as he had hoped. A buyer will say, "We have got what we want, but we will give you half-a-crown for the load," and rather than take it back he parts with it. It may be a big load of cauliflowers, and yet it is knocked down for half-a-crown. If we had co-operation, such dealing as that would be done away with, because the manager in the locality would regulate the supply. He would say, "I want so much produce to dispose of," and any excess could be manufactured in the way I have suggested. (Applause.)

The CHAIRMAN: Co-operation would be of great importance in the matter of purchasing the articles generally used by farmers in large quantities and retailing out to them. This is especially the case with respect to manures. (Applause.) Incalculable benefits are derived from this system elsewhere. Now that we are awakening to the value of chemical manures—superphosphates especially—why should not the union that has been formed for the purpose of selling wheat and cereals also purchase manures and sell them to the farmers and others at a lower rate than they can get them at present? (Applause.) We cannot get Peruvian guano here at reasonable prices. That is because no one imports a large quantity. We could import it direct from Peru if we liked. Farmers could charter a ship, and get it at something like the English prices. What would pay in England would pay here. We do not want quite as much per acre perhaps as they do in England, but our acres want some manure. At present the price of Peruvian guano is almost prohibitive; and so with all other chemical manures.

Scrub Lands and How to Utilise Them.

By A. J. BOYD,
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In my last paper I dealt with the question of scrubs, scrub-felling, and the maize crop. To what I said on the felling of scrub I must add that, although in the early days it was considered the correct thing to leave high stumps, to-day the practice is to cut low in order to permit of the passage of drays. A farmer who in former times did not lay his scrub so flat that the tops of the stumps were visible was considered to be a "new chum" at the work. The object of leaving high stumps was mainly to have good leverage power when the time came to stump the land.

In some parts of the North the initial cultivation is done with picks. The land is lined with cane-rows, generally 4 feet 6 inches apart, and in these rows cane-holes are made 3 feet apart. The proper size for these holes is 15 inches long, 12 inches wide, and 10 inches deep, cleaning them out to this depth, then loosening the soil again in planting.

This work, even with kanaka labour, is slow and rather expensive, but in the long run it has proved not only cheaper but much better than the system now generally adopted—viz., simply driving a pick or hoe into the soil and putting the cane plant in. Good crops have been obtained by this method, but owing to the plant being put so near the surface, and to the natural tendency of the cane to grow upward, it does not ratoon either as often or nearly as well as by the holing plan. The latter was the method adopted on my own and all the neighbouring scrub plantations on the Southern rivers.

To counteract the effect of the shallow planting, a system of hilling up is resorted to, which is actually injurious to the cane; and it seems impossible to make many farmers understand the difference between moulding cane and hilling it up. I am aware that hilling-up is a common practice, but that does not make it either a right or a wise one. This is a subject which might well be dealt with in a separate paper.

In hilly scrub country, such as I have seen at Mackay, where the hills are very steep, shoots are used to carry the cane in places where carts cannot go in safety, and on some hills wire ropes have been used and the cane sent to the bottom in bundles. But both these methods entail considerable expense, and with the present low price of sugar I doubt if it would pay to touch land requiring such methods.

Of course, after the removal of the stumps, which have mostly become rotten after several crops have been taken off, the plough can be used, even on the hillsides, if not too steep.

And this brings me to the question of stumping. It takes about three years for the general mass of stumps to rot. The smaller ones will have disappeared in less than two years, owing to constant cultivation and consequent destruction of the roots. Various plans have been adopted at different times to bring the land under the plough. Some farmers break up the whole of the land with the hoe, taking the stumps out on a face. Others merely take out the stumps without breaking up the land, and when stumps and roots are burnt off break the ground up with a strong bullock plough—a work which can easily be performed, as the tangled mass of roots is completely rotten by the end of three years. Once the plough can be set to work the cultivation differs very little from that adopted on plain lands.

The great depth of rich vegetable humus in most of the coast scrubs provides an almost inexhaustible supply of plant food, but there are climatic drawbacks which have to be considered. Periodical droughts occur of greater or lesser intensity, and this fact leads to the consideration of irrigation. Irrigation has its advocates and also its opponents. Whether cane will profit

by irrigation or not is a matter for the cane-growers of the present day to consider. When I was last in Mackay, Mr. Davidson showed me a patch of cane which he had irrigated, and there is no doubt that it looked far ahead of the non-irrigated cane. Mr. McCreedy has an irrigation plant on his property not far from Branscombe, and I am told that last year his returns were lower than where irrigation had been carried on, and last year was one in which the value of irrigation could well have been demonstrated. But to get good results from irrigation, drainage must precede it.

The sugar-cane is a crop which withstands drought in a remarkable degree, but it cannot withstand excess of water. For example, while a crop of young cane will withstand a drought of three or four months, two months of heavy rain on undrained land will completely kill the crop. This was my experience, when on the failure of the Bourbon cane I planted a field of Black Java on the lowest portion of my plantation, which it was impossible to drain. When heavy rains came the land was saturated, and the plants turned yellow and sickly looking. A spell of dry weather, helped by surface drains, brought them round, but there were no ratoons next season. The roots died out. It is quite probable, as a Mackay planter tells me, that the Queensland farmers have lost ten times more from excessive rain on undrained land than they have from drought. It was well shown by Mr. A. Watt, in a paper he read on sub-drainage at the late Agricultural Conference, that drained land withstands drought much better than undrained. Draining allows of the work being done (especially planting) when the conditions of heat and moisture are most favourable to plant growth. Drained land is much warmer than undrained, for if the excess of water is not relieved by artificial drainage it can only disappear by evaporation, and thus reduces the temperature both of soil and atmosphere.

There is undoubtedly a certain loss from drainage, but is it any greater or indeed so great as where there is no drainage? I think not. A Northern correspondent states it as his conviction that in the Mackay district alone, had all the land been thoroughly drained, the output last year would have been more like 35,000 than 17,000 tons, despite the drought.

These considerations concerning drainage are inserted here for the consideration of those scrub farmers who take up lands such as many of those I have seen at Cootharaba, in the Noosa district, where a stiff yellow clay underlies a rather shallow superstratum of rich soil. It was here that one of the ill-fated co-operative settlements tried to found a home, and found that the land was unsuitable for farming operations. Here drainage would have been of infinite value, although probably the expense could not have been borne by the community. The scrub lands in this lake country are very extensive, and eventually, when scientific farming is the order of the day, large quantities of produce will be pontooned across the lakes and down the Noosa River to Brisbane.

On the other hand thousands of acres of the scrubs between the coast and the main ranges overlie sandstone at varying depths, and can be cultivated without the necessity for drainage. Here oranges, lemons, &c., are grown to perfection; maize, potatoes, and other crops, which do not draw their food supplies from a depth, also succeed admirably; but lucerne in such localities is invariably a failure.

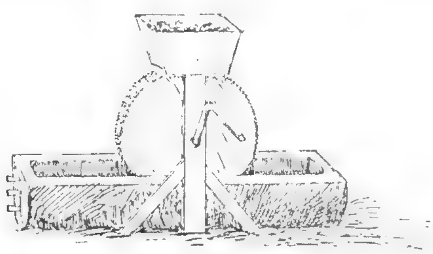
On our rich scrub lands there are few crops that cannot be successfully grown, although for some, such as wheat, the very richness of the soil is a cause of failure until successive crops have brought the land into a condition favourable to their growth. Every possible care should be taken to avoid the introduction of nut-grass. It needs only a trip to the Albert and Logan Rivers to see how widely spread is this pernicious weed. Once it has taken possession, its eradication is, if not a matter of impossibility, at least doubtful. I hear from a correspondent that, having discovered a patch of nut-grass on his farm, he did not dig it out, but just let it alone and planted buffalo-grass all round it. He is satisfied that this will wipe out the nut-grass as effectually as it has done the *Sida retusa.*

Sweet v. Sour Whey for Fattening Pigs.

THE *Scottish Farmer*, quoting from *Farming* (Toronto), says:—"Professor G. E. Day has been carrying on an experiment in fattening hogs with sweet as against sour whey, the results of which are somewhat surprising. It is commonly thought that sour whey has little or no feeding value; but the results of this experiment, which was repeated with another lot of hogs, go to show that its feeding value is practically equal to that of sweet whey. In August Professor Day chose nine uniform hogs, and separated them into three groups of three each. Group 1 was given a ration of meal and water; Group 2, meal and sweet whey; and Group 3, meal and sour whey. They were fed these rations from 22nd August to 16th October—a period of fifty-five days. The meal was moistened with the water, sweet or sour whey, as the case may be; about 2 lb. of whey was used to 1 lb. of meal. On 15th October a second experiment was commenced similar to the first with another lot of hogs, and continued for forty-two days. The results of the second experiment were very similar to those in the previous one. Taking an average of the two experiments, Professor Day found that the hogs in Group 1 (water) made a daily gain of 1·43 lb. live weight for each hog; Group 2 (sweet whey), 1·76 lb.; and Group 3 (sour whey), 1·78 lb. It is too soon to draw conclusions, however, though the results of the two experiments correspond very closely. This work will be continued again next season. These experiments go to show that 100 lb. of whey (sweet and sour) has a feeding value equal to 13·31 lb. of the meal used, and, at the prices paid for grain, the value of the whey would be about 8 cents. Professor Day does not say in his report how sour the whey was or how it was handled. Whey allowed to sour in cans or something of that sort, will not get so rotten sour as it does in many of the whey tanks at cheese factories, and thus misleading results may be obtained from such experiments. An acid test might be made of the whey as taken from factory tanks, also of whey that stands in cans for twenty-four hours after it comes to the farm, and more definite knowledge obtained upon the subject."

A Home-made Arrowroot Mill.

WE were lately asked by a farmer in the Blackall Range how to make an arrowroot-grinding machine. He had arrowroot growing on his farm, and wished to make enough starch for domestic use. The only method he knew of was to grind down the bulbs on a large tin grater, but the results did not compensate for the labour. As we were once in exactly the same predicament, we cannot do better than describe the primitive machine which we invented, and which proved eminently successful. Being far distant from any place where a machine could have been constructed, not to mention the detail of a scarcity of cash, we constructed the machine as follows:—First, a log about 2 feet in diameter and 8 feet long was hollowed out by axe and adze into a trough. At the head of this trough was fixed a framework much like the wooden stand of a grindstone. A large wheel was then cut from a sound log. This wheel was about 3 feet in diameter and 1 foot wide. Tin plates, turned into graters (which required frequent renewal) by punching holes in them



with a nail, were next nailed on to the edge of the wheel, to which a wooden axle was fitted. The wheel, when placed in position, turned in the water with which the trough was filled. Above it was a wooden hopper, through which the bulbs dropped on to the wheel. This was turned by a man with ease, and the grated bulbs went into the water in the shape of pulp and starch. The latter gradually settled at the bottom, and the pulp was removed with a narrow-tined fork and also by hand. After a short interval to allow the starch to settle down firmly, pegs were withdrawn from the lower end of the trough, and the water drawn off. The arrowroot was then dug out of the bottom of the trough and passed through calico stretched over a tub. By stirring it round with the hand on the calico, and at the same time pouring water on it, the whole of the starch passed through into the tub, leaving the gross impurities behind. This operation was performed three or even four times, until the arrowroot was perfectly white and quite free from any foreign substance. After the last washing, it was placed on shallow trays and dried. With the machine described, we not only made sufficient arrowroot for our own use, but we sent a quantity home to our friends, and sold the balance in Brisbane at 1s. per lb. This was in the year 1863. Such a machine, however, would scarcely enable a grower to-day to make a profit out of arrowroot.

The Sugar Beet Industry.

CLIMATE AS RELATED TO THE SUGAR BEET INDUSTRY.

Dr. H. W. Wiley, the well-known Sugar Chemist of the United States Department of Agriculture, has (says the *Pacific Rural Press*) emphasised the fact that California has distinctive advantages for beet culture. We reproduce portions of Dr. Wiley's paper, as it cannot fail to be of great interest to all concerned in sugar-growing in this colony:—

"*The Beet Belt.*—Dr. Wiley says that experience has shown that the sugar beet reaches its highest development in north temperate latitudes. So far as the production of beets with high tonnage is concerned, it is found that this can be accomplished far to the south, but beets grown in such localities are, upon the whole, less rich in sugar and less suitable for the manufacture of sugar than those grown farther north. It must be remembered, however, that the expressions north and south do not refer to any absolute parallels of latitude, but rather to isothermal lines, which in many cases run obliquely to the parallels of latitude and in some cases cross them almost at right angles. As a result of many years of careful experimentation, it may be said that, as far as temperature alone is concerned, the sugar beet attains its greatest perfection in a zone of varying width, through the centre of which passes the isothermal line of 70 degrees Fahr. for the months of June, July, and August."

The theoretical beet-sugar belt of the United States is defined by the position of this isotherm, and may briefly be traced from New York to Lake Erie (Ohio); thence to Michigan, reaching its highest point at Lansing. Then, going south-west, it enters Indiana, changes direction to the north-west, and continues through Chicago, attaining its highest point near St. Paul, Minnesota. Again, turning south-west, it enters the State of South Dakota; then runs north-west and reaches its highest point in Dakota about 45th parallel of latitude. Then it passes almost due south, following the 101st degree of longitude till it reaches the north-east corner of Colorado; then passes into New Mexico, turns to the west, and crosses the 105th degree of longitude at about the 32nd degree of latitude. Then, turning westward, it passes in a very irregular line through the States of California, Oregon, and Washington.

Now what does all this mean? It means that here are some millions of acres of land said to be adapted by climate to the growth of beet. The amount of sugar consumed in the United States annually, the doctor puts down at 2,000,000 tons; and with 100,000,000 acres of arid land, one-fifth of the total area of the States, 10 per cent. of which are capable of easy and speedy irrigation, it is not too much to prophesy that the beet-sugar industry will make such rapid strides in the country that the home consumption will ere many years be supplied. It would only require about 120 factories such as that at Chino (Cal.) to compass this result, provided farmers will grow the beets. Will it pay the farmers to do so? Again quoting our authority:—"The northern parts of our Eastern and Middle States and the States of Oregon and Washington have at least an equal chance for the successful production of beet sugar with the fields of Germany and France. The irrigable parts of the great south-west, it is believed, have advantage of soil and climate which will enable them to enter into competition even with the Hawaiian Islands and Cuba. To be able to control the moisture in the soil is a matter of prime importance to the beetgrower. In the arid region, the beet can be left to mature at the proper time by withholding the water. Subsequently there is no danger of loss due to second growth, so easily induced by late warm autumnal rains. In a dry soil, the beet can endure without damage a low temperature, which would prove quite disastrous in a wet climate. More complete maturity may be thus

obtained, and a more leisurely harvest. In fact, there is no staple crop which can compete with the sugar beet in demanding the favourable attention of those interested in irrigation. If a net profit of from \$10 to \$20 (£2 to £4) per acre can be secured, from \$100 to \$200 (£20 to £40) per acre can be paid for the land. It is estimated that nearly 100,000,000 acres of land in the arid regions of the United States may eventually be irrigated, being nearly one-fifth of the total area. Of this area perhaps 10 per cent. are capable of easy and speedy irrigation. One million acres planted to beets would yield, under intensive culture, a quantity of sugar sufficient, with the Louisiana product, for domestic consumption. There is nowhere in sight a more promising prospect for agricultural development than in the production of sugar beets on irrigated lands.

" *Growth of Beets on Irrigated Lands.*—The experience of more than ten years in California has shown that the climatic data, regarded as of prime importance in beet culture in Europe, cannot be regarded as rigidly applicable to this country. The successful grower of sugar beets in the arid regions of our country, with and without irrigation, has introduced a new factor into the science of beet meteorology. While the arid area on which the beets can be grown without irrigation is probably confined almost exclusively to the coast valleys of California, the successful commercial production of sugar beets in Utah and New Mexico has opened up a new and extensive field for the extension of the sugar industry over large areas suited to irrigation in the western and south-western regions of the United States. It is certain now that Colorado, Utah, New Mexico, Idaho, and Arizona may become great sugar-producing States, not excluding other areas in the arid region. California has already set the pace of progress, and the other arid States will not be slow to follow. The high cost of good irrigation renders it imperative that the areas under culture be devoted to a crop which is capable of producing a more valuable yield than is afforded by cereal culture. Of all the home markets for our domestic agricultural products, there is none so insistent nor so expansive as that for sugar. With an annual consumption of 2,000,000 tons, and with a certainty of rapid increase, the demand for sugar promises to be the salvation of American agriculture.

" *Necessary Conditions.*—Extending a distance of 100 miles on each side of the isothermal line is a belt which, for the present, may be regarded as the theoretical beet-sugar area of the United States. There are doubtless many localities lying outside of this belt, both north and south, in which the sugar beet will be found to thrive; but this will be due to some exceptional qualities of of the climate or soil, and not to any favourable influence of a higher or lower temperature. A mean temperature of 70 degrees Fahr. in the summer, however, must not be regarded as the only element of temperature which is to be taken into consideration. In those localities where the winters come early and are of unusual severity will be found greater difficulties in the production of sugar from the sugar beet than in those localities where the winters are light and mild, although the mean summer temperature in both localities may be represented by 70 degrees Fahr. As an illustration of this difficulty may be cited Northern Nebraska and South Dakota, where the winters are of great severity, and Southern California, where there is scarcely any winter at all.

"The mean summer temperature of these localities is about the same, but the continuation of a semi-summer temperature through the winter in Southern California greatly favours the growth and manufacture of the beets. In Northern Nebraska and South Dakota the beets, which are to be manufactured during the winter time, have to be protected by expensive silos. In Southern California and other places similarly situated the beets can be protected without any covering, or at most with only a slight covering of leaves or straw. The season for planting in a mild climate is also longer.

" *Conditions of Precipitation.*—Although conditions of temperature must be taken into consideration in selecting sites for beet-sugar factories, yet in addition to the thermal conditions must also be studied those of rainfall. The

sugar beet requires a certain amount of moisture in order to produce its normal crop. This moisture must be derived either from precipitation in the usual way, by irrigation, or else the soil must be of that particular quality which will allow subterranean moisture to reach the rootlets of the plants. Soil of this latter kind appears to exist in many localities in California, where beets are grown almost without rain. The porous and sandy soils adjacent to many of the western rivers, such as the Platte River in Nebraska and the Arkansas River in Kansas, also appear to furnish a sufficient amount of subterranean moisture to produce a good crop in connection with the rainfall, of which, however, but little is expected in those localities during the summer months. Where there is little subterranean moisture, and where irrigation is not practicable, the endeavour should be made to secure localities for the growth of the sugar beet where an average summer precipitation of from 2 to 4 inches per month may be expected. There are many conditions of agriculture, however, under which the beet becomes quite independent of extremes of precipitation. The beet may thrive with very little rainfall or with a great deal, if properly cultivated in a suitable soil."

It will thus be seen that the conditions of climate and soil under which the beet will thrive are such as to enable the farmer to produce the crop under circumstances where cane cultivation would be a dead failure. It is this very facility of growth and cultivation, and the vast extent of country available in many parts of the globe for the sugar beet industry, that makes it such a formidable antagonist to the canegrower, not to mention the subject of the bounties on beet sugar in continental countries. As it is, our sugar factories have to be worked with the greatest care and judgment to merely pay interest on the outlay for machinery. What will it be when the southern colonies are supplied from within themselves, and when foreign markets are still further flooded with beet sugar?

From the same source we take the following figures as to the beet-sugar industry in one district of California:—

"*A Great Beet Year.*—The beet season is now so far advanced that it can be said definitely that Chino will this year have not only the greatest acreage of beets in its history but that the yield per acre will exceed that of any former year. Reports from Anaheim and Hueneme are to about the same effect, and it is now roughly estimated that the Chino factory will this year handle in the neighbourhood of 120,000 to 130,000 tons of beets, from which there will be extracted something like 17,000 tons of refined sugar. If the price of beets average $3.50 per ton this will give the beetgrowers about $450,000, while the factory will also pay about $125,000 for crude petroleum for fuel, and a large sum for wages and other expenses. Thus it is evident that the company will distribute over $500,000 within the next six months. It will not be a losing investment for the company, however, as, without considering the bounty question, the output of sugar from the factory, at 4 cents per lb., will be worth about $1,360,000. The immense stretches of beet-fields now present a striking appearance. For miles the sea of beets is spread before the eye. They are growing with wonderful rapidity, and the farmers all wear happy looks in contemplation of the coming harvest.—*Chino Letter.*"

Dr. Wiley has been often asked the question "if beet sugar cannot be made in a small way so that farmers could club together, put up a cheap apparatus, and produce their own sugar? On account of the elaborateness of the process and the costly nature of the machinery which is necessary to produce beet sugar even in a small way, it is not believed that it could be profitably made in the way indicated. A small factory could not possibly compete with a large one; and hence there is no encouragement to be offered in the way of producing home-made beet sugar.* The Department has no knowledge of any successful beet-sugar factory of this kind. There is no country producing any notable quantity of beet sugar in which home apparatus costing only a few thousand

* Old Queenslanders will remember the disastrous results of experiments with small sugar-mills in 1870.—Ed. *Q.A.J.*

dollars have any appreciable influence on the output of sugar. Russia has been cited as an exception to this rule. The output of beet sugar in Russia annually is about 750,000 tons. The total number of factories in operation is about 300. The average annual output of each factory in round numbers is 5,000,000 lb., representing an average consumption of 25,000 tons of beets. From these figures it is seen that the average size of the Russian beet-sugar factory is not greatly different from that of other European countries.

"*Waste Products.*—The waste products of the factory consist of the pulps and molasses. The molasses is used for various purposes, either for making sugar, for fertilising purposes, for the manufacture of alcohol, or sometimes for cattle food. The pulps make a valuable cattle food. They may be fed in the fresh state or preserved in silos. Lately extensive experiments have been made in drying the pulps and preserving them in the dried state, and these experiments have been fairly successful. It is stated that the value of the pulps for feeding purposes is from one-fourth to one-fifth of the value of the beets.

"*Cost of Manufacture.*—The cost of manufacture depends on as many factors as that of beetgrowing. Chief among these are transportation, fuel, weather, and labour. Perhaps the most important of these factors is the price of fuel. In some localities coal can be had for $1·25 per ton; in others the cost may reach as high as $10 per ton.

"The manufacture of beet sugar is conducted without governmental supervision in this country, and any exact account of its cost is inaccessible. To show what it may be, with large experience and the highest skill and management, the mean cost of manufacture in 113 German factories is given:—

Mean capital invested in each factory		* $193,400·00
Total receipts for sugar, molasses, and pulps per ton of beets ...		$11·10
Mean cost of beets per ton of 2,204·62 lb.	$4·90	
Salaries per ton of beets	·26	
Labour per ton of beets	·73	
Interest on investment per ton of beets	·36	
Coal per ton of beets	·63	
Miscellaneous expenses per ton of beets	·96	
Total expense of manufacture per ton...		† 7·84
Profit per ton of beets		‡ $3·26

"The mean net profit for each factory was $34,240. The price paid for beets, however, is in most cases fictitious, the beetgrowers owning the factory and preferring to share in the general profits rather than to charge a high price for the beets. First-class beets rarely sell for less than $5 a ton. The Western Beet Sugar Company, of Watsonville, Cali., stated that in its first campaign, 1888-9, the cost of manufacture amounted to $80·80 (£16 16s. 8d.) per ton of sugar. At the present time it appears that with the best machinery and most economical processes beet sugar can be made in this country at a cost of from 3 to 4 cents per lb. when the price of rich beets does not exceed $5 a ton.

"*Cost of Factory.*—The cost of building a first-class beet-sugar factory is much greater than is commonly supposed. From the most reliable data at hand it may be stated that in Europe the cost of erecting a factory with the most modern machinery, of a capacity of at least 300 tons of beets per day, is about $200,000. In this country it is probable that, owing to the increased cost of transportation and the higher price of labour, the cost of a similar factory would be at least $250,000. As has been intimated before, it is not advisable to attempt to manufacture beet sugar with smaller factories or with machinery and appliances which do not represent the latest improvements. It is true that there are many parts of a sugar factory which have not changed much within the last twenty years, but even the multiple-effect apparatus, the strike-pans, and the centrifugals, which represent the most stable parts of the machinery, have undergone considerable changes within the time mentioned.

* About £40,000. † £1 13s. ‡ 13s. 6d.

Probably one of the greatest dangers which the beet-growing industry in this country will meet is the tendency to begin the erection of a beet-sugar factory with cheap, old, or worn-out apparatus and appliances, and without a proper technical study of all the questions involved. The avoidance of this danger is all the more difficult, because there are few engineers in this country who have devoted themselves to the study of this problem, and European experts are not likely to understand and comprehend American methods and measures. Numerous inquiries have been received at this office for directions for making beet sugar with such appliances as a cider-mill and sorghum-molasses evaporator might afford. It would not be right to encourage the attempt to manufacture beet sugar in any such way. Nor should the expectation be excited among our farmers that they will be able to make a crude article of sugar which they can dispose of to a central factory for refining purposes. It is best to recognise at the very first the great expense which attends the erection of a sugar factory and the necessity for its meeting every modern requirement. Beetgrowing and beet-sugar manufacture are two distinct industries, but with common aims and interests.

"*Co-operative Factories.*—It is seen from the foregoing paragraph that the farmer can have no reasonable hope of successfully establishing a home beet-sugar factory. It is not just, however, that he should be deprived of any co-operation in the process of manufacture or a reasonable share of the profits arising therefrom. The methods which have been practised in Europe for securing these results are probably those which will eventually come into use in this country. The co-operative sugar factory, in which the farmers growing the beets hold a part or the majority of the stock, realises the desired end. The growers of beets holding shares in the factory have greater interest in its prosperity, try to grow better crops, and to secure in every way a higher yield. The co-operative factory renders impossible those disagreements between capital and agriculture which do so much to retard the progress of the industry and to embitter the feeling of the farmer against the factory. To show the extent of the participation of shareholders in factories in the growing of beets in Germany, it may be stated that, of the 11,672,816 metric tons of beets delivered to the German factories in 1895-6, 2,689,004 tons were grown by shareholders. Inasmuch as the farmers in a beet-sugar community are uniformly prosperous, they are able to subscribe for shares in a factory, and by a community of interests practically control its operations. The industry of growing beets is not yet sufficiently advanced in the United States to render possible any definite outline of the best plan of securing co-operation between the farmer and the capitalist. At the outset, it would probably be impossible to secure among the farmers alone a sufficient amount of capital to properly equip a factory. Even could this be done, the additional difficulty would be encountered of a lack of experience among the shareholders, leading to poor judgment in regard to the methods of conducting the manufacturing operations. As long as the proprietors of the factory and the farmers growing the beets are satisfied with the contracts which they make, there is no urgent necessity of the establishment of co-operative enterprises. When the number of beet-sugar factories in this country, however, begins to reach the hundreds, favourable opportunities of co-operative establishments will be presented."

A Coming Crop.

THE COW-PEA (*VIGNA CATIANG*).

BY HENRY A. TARDENT,
Manager of the Westbrook Experiment Farm.

ONE of the phenomena which most strikes the careful observer of the agricultural and economical conditions of Australia is the rapid deterioration and impoverishment of our agricultural lands. From east to west, from south to north, the signs of it are everywhere evident. In certain countries, renowned for their agriculture, judicious manuring and an intelligent rotation of crops enable the agriculturist to grow, every season, large and remunerative crops on soils which have been for hundreds, nay thousands, of years under cultivation. In other less advanced countries a periodical fallowing of the land provides the rest required by Nature. But here—as a rule—nothing of the kind is practised. As soon as the land is broken up, the settler grows on it the same crop year after year—in some places two or three times a year without manuring, without rotation of crops, without any fallowing.

As Nature never permits her wise laws to be sinned against with impunity, the results of that "Raüb-cultur," or "robbing cultivation," as the Germans call it with a proper and expressive word, are not slow to be felt.

The fertile plains of the south, where the pioneers of the early days used to grow from 25 to 35 bushels of wheat to the acre, are now reduced to an average of 10 and in some places even to 5 bushels to the acre. In the north of the continent, the sugar-growers begin to remark similar decreases in the returns of sugar-cane on soils which, in their virgin state, were considered to be amongst the most fertile in the world. The same may be said of the maize, banana, and pineapple lands, on which, not only the crops are on the decline but where they are also, every year, more and more subjected to various insect and fungoid diseases.

Such a neglect of the elementary principles of sound agriculture is the real cause of the many abandoned farms to be seen here and there in the very best agricultural districts of the continent. Nature rebels against the man who has become her tyrant and exploiter, instead of being simply her master and benefactor. The farm shakes off as a noxious parasite, the man who has been living on its vitals, instead of contenting himself with the legitimate yearly income of a well-cultivated land.

Where is then the remedy for such a regretable state of affairs?

The question is a vast and complicated one, and requires careful study. It embraces the whole subject of manure and rotation of crops, which it is not intended to treat in this short article, the writer wishing only to attract attention to the most menaced point and the one easiest to be remedied.

As is well known, of all the elements necessary to plant life, nitrogen is perhaps the most important. In any case it is the costliest and the most difficult to keep in the soil. This seems rather strange, when we remember that four-fifths of our atmosphere is composed of nitrogen, so that the plants are, so to say, constantly bathed in it. Unfortunately, plants do not absorb and fix nitrogen through their leaves as they do carbon. They eat it in the soil by the extremities of their rootlets when it has become what chemists call nitrates—that is, when it has combined with some other elements forming the humus or decayed vegetable matter of the soil.

But how does nitrogen get fixed into the soil, or, in other words, what produces that nitrification of the soil? The question has for thousands of years been a puzzle to the cleverest and shrewdest scientists of the whole world. True, according to Theophrastus, Pliny, and Columella, the ancients had empirically found out that they could enrich their soils by ploughing in green crops, and such a practice was extensively followed in ancient Greece and in many parts of the Roman Empire. At the beginning of this (nineteenth) century, chemical science had made sufficient progress to enable de Saussure, Boussingault, and others to explain that the beneficent effect of such ploughed-in crops was due to the singular property possessed by a numerous family of plants (the Leguminosæ) to provide, not only enough nitrogen for their own requirements, but also to leave a good supply of it in the soil in which they were grown. But how that was being done, remained still a mystery.

In recent years, however, the discoveries of Pasteur and Koch have completely transformed many of the natural sciences, by establishing beyond doubt that most of the changes which take place in Nature are the work of tiny organisms generally known under the names of microbes and bacteria. Being now put on the right track, two most conscientious and sagacious scientists (Willfarth and Hellriegel) directed their investigations on the various members of those nitrogen-producing leguminous plants. On most of their roots they found nodosities—or knots—and in those very nodosities, the tiny bacteria which first absorb the nitrogen and then fix it in the roots and soil.

Modern scientists take good care to leave us no room for doubting their assertions. For instance, if the bacteria of a leguminous plant are killed—or sterilised, as the operation is called—that plant will grow like any other ordinary plant, without producing any nitrogen whatever, and taking from the soil that which it is in want of to form its tissues (protoplasm) and cells. Still more wonderful: Those tiny nitrogen-producing organisms are being isolated and cultivated—that is, multiplied like farm animals. They are then put in hermetically sealed bottles and sold—under the name of "nitragin"—to farmers, who sow them on their land. And at once those bacteria start their wonderful work of absorbing nitrogen and transmitting it to the soil.

But those ultra-scientific means of enriching our lands with nitrogen are not yet within our reach.

Fallowing, during which it is probable that as yet unknown bacteria enrich the soil with nitrogen, is not to be recommended in this country, especially in summer. It is not improbable that the great heat kills those useful beings or paralyses their action. In any case it is in some way injurious to them. If any nitrogen is being formed during fallowing, it is often washed by heavy rains out of the reach of plant roots. And, finally, fallowing gives full play to noxious weeds which take hold of the field to the great detriment of the following crops.

Commercial nitrogenous manures are not seldom either too expensive or require too great an expenditure of labour to be profitable. So that the simplest and cheapest way to give our fields the nitrogen they absolutely require, especially for cereals and other exhausting crops, is to grow on the fields leguminous plants, and plough them under whilst they are still in a green state. During his long residence in Western Queensland, the writer has been experimenting for years with plants of that family, with a view to finding one answering all the requirements of a fertilising crop. None gave him entire satisfaction. Some, as lucerne, for instance, occupy the land far too long to form part of a regular rotation; others are of slow growth, or cannot stand the drought or a wet season. He was beginning to doubt of ever succeeding, when a few years ago the solution came to him from quite an unexpected quarter, when he received from the Department of Agriculture a few seeds of the so-called "cow-pea," which Professor Shelton had recently introduced from America into Queensland. If the cow-pea is given in our national economy the place it deserves, it is bound to entirely revolutionise our agriculture. The time will come when it will be recognised as the most important economic plant

ever introduced into Queensland, not excepting wheat and sugar-cane. The only faults to be found with it are its botanical and vernacular names, both of which are at the same time misleading and nonsensical. It is not a *vigna*; it is still less a *pea*. It is more like a French bean than anything else in the vegetable kingdom, except that it is more vigorous, hardier, and more prolific.

There are many varieties of it, such as the Black, the Large White, the Small White with a small eye, and the Clay-coloured, &c., each of which has its advantages. The writer has so far grown only the two last-named, and found that the Small White is superior as a green vegetable (cut up like French beans or boiled as peas), whilst the Clay-coloured seems preferable for green manuring and as a fodder plant.

Mr. Valder, whose opinions on all agricultural matters deserve always the greatest consideration, has grown successfully the four abovenamed varieties at the Wagga Wagga Experiment Farm, New South Wales. He recommends the Black and Clay-coloured for manuring, the Small and the Large White for culinary purposes.

Here, in Queensland, the cow-pea is likely to do well in every part of the colony. It might happen though, in the course of time, that in the hot moist North it will be attacked by the Common Bean Rust (*Uromyces phaseoli*). But, so far, no complaints of any kind have been heard, although I understand the cow-pea is already extensively grown there by the Colonial Sugar Refining Company and other planters who carry on agriculture on scientific lines and as a paying concern.

In the West it does admirably. It likes a shower at planting and just before flowering time. But, taken all round, it stands—with proper cultivation—the longest of droughts remarkably well. During the last trying season, after four months of uninterrupted drought, the cow-pea plot was standing vigorous and healthy, with its dark-green foliage as fresh as in a hothouse.

The cow-pea thrives in almost any soil, although it does best, of course, on a friable, sandy loam. The land must be ploughed deep, and be well pulverised. A dressing of wood ashes is the manure most likely to be beneficial. It can be planted—for main crop—as soon as the frosts are over. It is very sensitive to cold, the slightest frost killing it. The rows should be 3 feet apart, and the plants 1 foot apart in the rows. When planted in rows one bean is enough for a plant, in which case about 8 lb. will sow 1 acre. With favourable weather, the plants appear over ground in from three to five days. Keep the weeds down and the land in good tilth with the Planet junior, at first deep set and then gradually shallower (the last point is very important). In a couple of months, the plant will take care of itself, the whole field appearing as an uninterrupted mass of foliage. If grown for green manuring, now is the time —that is, when the flowers begin to appear—to roll it down and plough it under; the plough being provided with a Yankee mouldboard, a sharp revolving coulter, and a heavy chain dragging in front of the mouldboard. If time permits, it is not a bad plan to let it rot on the soil. It can also be mown down and made into excellent ensilage, especially if mixed with corn or sorghum; or it can be turned into hay. This latter is a little difficult to gather at the proper stage of dessication. If too dry, the leaves crumble into dust; if too green, the thick, juicy stems may turn mouldy in the stack. With care and attention, both drawbacks can be avoided. In that case the whole stack will undergo a gentle fermentation, and the hay will appear of a slightly brownish colour and emit a sweet honey-like fragrance.

The cow-pea can also be eaten down in the field by sheep, cattle, and horses, which are all very fond of it.

And last, but not least, it can be grown for its beans as a money crop, and by no means a bad one either.

The pods have to be gathered by hand as they ripen. Children are especially skilful at that work, provided they are shown that they must not pull on the plant, but gently break off the pods with their thumb-nail. There are, as a rule, from 20 to 40 pods per plant, each containing from 10 to

15 beans, which means a return of from 25 to 35 bushels to the acre. As soon as gathered they should not be heaped, but stored carefully in an airy place to dry. In the bush a good plan is to put them in thinly woven bags, and hang them under the veranda-roof. They can then be thrashed with a flail. Be careful though not to hit too hard or to thrash when the beans are too dry, otherwise many beans will be crushed. Then pass through the winnower. Should none be available, select a windy day; pour the beans from a dish held level with the shoulder into a tub lying on the ground—twice or even three times in succession—by which means the wind will blow away all the particles of parchment-like pods, leaving the beans perfectly clean. Then bag and keep in a dry place.

Have them for sale, as they are now in great demand at 3d. per lb., which means a return of from £15 to £25 per acre. Have them in store the whole year round for your own and your family's use. They form at all seasons a most acceptable food, being the most concentrated and most nutritious of all vegetables. If still a few are left, boil them and feed them to pigs, which will turn them into an excellent bacon.

If we sum up, we now find that the crop of cow-pea has provided you at your choice:—

1. With green pasture for farm animals.
2. With ensilage.
3. With hay.
4. With a good supply of beans, which means a handsome cheque per acre, and a good saving on the butcher's, baker's, and grocer's bills.
5. It has kept your land perfectly free from weeds.
6. It has enriched it with an abundant supply of the precious nitrogen; so abundant in fact that the visitors to the farm, seeing the extraordinary difference in favour of the plants—wheat and maize—grown on the cow-pea plots, would ask whether there had not been a sheepyard there before.
7. It has not appreciably impoverished the soil of its mineral matter, as the cow-pea has powerful roots—sometimes 1 inch in diameter, which sink deep and wide in search of food, loosening the soil in every direction and bringing its mineral constituents within the reach of the roots of the following crops.
8. It leaves the land in a perfectly pulverised state.
9. It does not occupy the land long. When sown in the spring, the crop is gathered in December and January, and can be followed by corn, sorghum, millets, pumpkins, potatoes, &c. If sown in November, immediately after harvest, it has yet time to mature before the next sowing season comes in.

Conclusion.

Mr. Brünnich, the Government Agricultural Chemist, who has had considerable experience with the cow-pea, estimates its manurial value at £5 per acre. That means that every year in three months' time, and for 2s. worth of seed, the Queensland farmer can increase by £5 per acre the value of his cultivated land. Let everyone now pause and reckon by how much he can make himself richer, according to his acreage.

For the 300,000 acres we have now under plough in the colony, the above figures represent £1,500,000 taken annually directly from the inexhaustible reservoir of the atmosphere and transmitted to the soil by the medium of the cow-pea, and those marvellous helpers conquered and, so to say, domesticated by science for the use of the intelligent and progressive farmer!

Agricultural Schools and Experiment Stations.

NONE but those who follow the expansion of the agricultural industry of foreign countries can form any conception of the great importance attached to the necessity for fostering, by State aid, the interests of the farming and dairying classes of their respective countries by the Governments of the United States, Germany, France, Belgium, Russia, &c. We, in Queensland, are being forced by competition to recognise that the old methods of farming and dairying are no longer profitable. We must move with the times or be hopelessly left behind in the race. We have, however, made a commencement. The Department of Agriculture is very much alive to its responsibilities. Both the Government and the people, as a body, recognise that now, as in the days of Rameses and Solomon, the support of a nation lies in its agricultural resources : "The king himself is served by the field." The sinews of war are said to be money, but the real sinews of war are supplies; and if they are not forthcoming, armies and navies are helpless. Therefore, it is the duty of all patriots to exert themselves to the utmost to foster and extend the profession of agriculture. It may be difficult to move older men out of a groove they have moved in for many years. What suited their fathers still suits them, but it will not suit the younger generation. These require to be moulded into intelligent, educated, scientific agriculturists. Hence the necessity for colleges, dairies, and experiment farms. Where these are under proper supervision and conducted on a liberal (not extravagant) scale, no greater boon could be conferred by a Government on its people. The students at the various stations will go forth to the world with enlarged ideas, instructed in the latest and most economical methods of cultivation, harvesting, and marketing their produce. There will be no happy-go-lucky wasteful methods in their farming operations. Besides this they will, by their example and let us hope, by their success, induce many who have not had the same advantages to follow their example; and the result cannot fail to be a beneficent one, not only to this colony, but to those to which our products are exported. We have been led to these remarks by a perusal of the report of the Agricultural Experiment Stations in Prussia (Germany), which is one of the most interesting of our exchanges. From it we extract the following, which will doubtless be of interest to many of our own readers :—

"Prussia, with its 134,500 square miles and about 30,000,000 inhabitants, has 42 agricultural experiment stations and agricultural schools; 16 of these are general stations, doing all classes of practical and scientific work and research; 7 are stations of control, doing chiefly tests of seeds, soils, manures, &c. There are 12 special stations for the benefit of the sugar industry, brewing, fruit and wine culture, &c.; besides 7 agricultural schools, academies, and universities. The staff at these establishments is an enormous one, comprising about 64 directors (chiefly chemists), with 95 assistants, 5 bacteriologists, 29 botanists and entomologists, 14 engineers and surveyors, 18 clerks, and numerous laboratory servants. The total income of the experiment stations (excluding schools and universities) was in the year 1894, the complete report of which is just to hand, £56,600, of which £11,200 was contributed by the Government, and £40,000 was taken in payment of analyses and other work done. The expenses amounted to £53,800.

"The work carried out at these stations is an enormous one, and we append here a list of analyses and tests carried out by the scientific staff:—

Analyses and tests of	manures	... ...	31,012
" "	fodders	... ...	12,587
" "	seeds...	... ...	9,353
" "	milk ...	... ...	40,524
" "	soils ...	... ...	1,755
" "	waters	... ...	1,891
" "	sugar beet	... ...	2,237

"The scientific researches come under the following headings:—Atmosphere, Soil, Cultivation, and Plant Products, Animal Products, Agricultural Technological Industries, Horticulture, Viticulture, &c. All these headings are subdivided into many other branches. Under Cultivation and Plant Production we find, for instance:—

1. Plant nutrition, manures, conservation of manures, manuring trials in field and pots, green manuring.
2. Rotation of crops and modes of cultivation.
3. Improvement of plant varieties.
4. Cultivation of pastures and meadows.
5. Plant pathology.
6. Plant physiology and morphology, &c.

"The work under the other headings is equally complete; and a list of the work to be continued and of new work for the coming years shows how much still remains to be done."

Red Devon Cattle.

THE following very interesting remarks on the probable origin of the Red Devon Cattle has been handed me by Mr. James Moffatt, of Warrill Bank, and will, I am sure, prove an interesting contribution to the *Queensland Agricultural Journal.*

P. R. GORDON.

The Devon herd of cattle have long been regarded as amongst the oldest domesticated herds of British cattle, and there is a theory or tradition that it originated in Cornwall.

The researches and discoveries of Egyptologists and other Eastern scholars go far to establish the fact that in all probability the Devon is a living representation and descendant of the red cattle which we find were raised with the aid of all the wisdom of the Egyptians upwards of 5,000 years ago, to use as sacrifices to the Sun Deities—the red colour being evidently symbolic, and considered not only most acceptable, but necessary for the propitiation of their gods.

They were raised with great care; those showing black hairs were rejected as unfit for sacrifice, and the names and portraits of individual animals of merits are to-day found inscribed on the monuments. Studying the portraits, we readily recognise their similarity to the Devon; it had many points of a good milker, but the low set-on of tail and rump would greatly reduce the total number of her points if judged for milking qualities by our modern system of point-judging. She is not formed in the square blocky lines of our modern beef-producing herds, but rather represents an animal which we would expect to die well, giving a good yield of caul fat, which may have been a consideration with the Egyptian priesthood, as we know it was, later, to the Jewish priesthood; and we have reason to believe that this eventuated in Amos, the herdsman of Yekoa's time, producing an animal that was only profitable to the priests. This is evident from the fact that when Amos struck out as a reformer he, a herdsman first, could find no more opprobious nor descriptive term for the oppressors of the people than to style them "Kine of Bashan"; to his mind they were alike unprofitable and inimical to the wealth of the people.

The Phœnicians long worked the tin-mines of Cornwall, and nothing is more natural and probable than that they, as sun-worshippers, would obtain cattle for their sacrifices that would satisfy the superstitions and ideas they held of the requirements of their gods.

We know, from the writer of Deuteronomy, that Bashan, in close proximity to the Phœnician ports of Tyre and Sidon, was, in his day, famed for its supplies of animals for sacrifice—both sheep and cattle. And the writer of Numbers discloses to us the fact that the worshippers of the true God, at Jerusalem, could not rise above the superstition of the sun-worshipping nation surrounding them, and that, under the Mosaic law, a red animal without spot had to be provided for sacrifice.

The Phœnicians have recorded the fact that they found the inhabitants of the tin islands (Britain) were clad in black cloaks and in tunics reaching to their feet, with girdles round the waist, and were bearded like goats; that they walked with staves; that they subsisted by means of their cattle, and for the most part led a wandering life. There exists also the mythical story of the great spoil of cattle taken by Hercules in Spain, clearly indicating that the

inhabitants of Spain and Britain were engaged in cattle-rearing pursuits long before the advent of the Phœnician colonists on their coasts, and that the possibility of a profitable trade in stud stock existed.

It seems only reasonable to infer that the Phœnicians, who were a trading nation developing markets wherever they touched in their long intercourse with such countries as Spain and Britain, which they found settled with a people subsisting by means of their cattle, would, apart from their own requirements for sacrifice, have fostered and developed a trade with the cattle-owners of these countries in stud stock from the scientifically bred herds of Egypt and Bashan.

All the evidences of the British cattle herds of the present day go to show that something of this kind has taken place. We find that the cattle belonging to the descendants of ancient Britain have most marked and peculiar characteristics which they hold in common (however varied breeds so different as the Jersey, Devon, Kyloe, or Galloway may be), distinctly pointing to the fact that they have sprung from a source other than the original cattle of the Norse and Saxon varieties, well represented to-day by the Shorthorn and Ayrshire herds.

One characteristic peculiar to the Celtic cattle is that they are whole coloured, generally red or black, dun or mouse coloured, whilst brindles are frequently met with, and it is quite a common thing for black and red animals to alternate in a herd.

In our time we find the reversion to black, which the Egyptian breeders had to contend against when raising a red herd, being fostered and developed by the owners of several herds, and this to such an extent that the red-coloured animals have been quite eliminated from their herds.

Another characteristic common to Celtic cattle is the peculiar marbling of their meat. This is not a quality of the Saxon cattle, as represented by the Shorthorn or Ayrshire. It is the marbling of the fat through the lean meat of the Celtic cattle that enhances its value, and causes it to realise top prices in the London market, whether it has been supplied from a Devon in the south of England or a Kyloe in the north of Scotland. Another distinctive feature is the quality of their meat. It did not need the development of the Babcock tester to demonstrate that the milk of the Jersey, Devon, Kyloe, or other Celtic breeds were rich in butter fats.

The Saxon herds are simply not in the show with them. Recently, in Scotland, a breeder of Celtic cattle bought some Ayrshires to supply the usual ration of milk for his ploughmen. Accustomed as they had been to the richer milk of the black Celtic cattle, the poorer milk of the Ayrshire was unpalatable to them, and caused friction and dissatisfaction. In the early days of New South Wales, a herd of cattle had been established which would have been of great value to Australia under the present aspect and promise of the dairying and meat industries. Where they came from, and how were they bred, would be interesting information of a most profitable nature, if it could be obtained. They were of a mouse or dun colour, soft to handle, as large framed as the Durhams running with them, their meat was marbled, and they gave a great yield of rich milk. As milkers they would have realised £10 per head more than Ayrshire cows in the cattle markets of Scotland. Normanby Station, near Ipswich, when first formed, was stocked with them, and late in the sixties they still formed part of the stock on that station, but the craze for Durhams had long before set in, and the spaying knife was freely used, with the result that a breed of cattle superior to the Durham for meat, and better than the Ayrshire for milk, was eventually wiped out.

The first settlers around Dunedin, New Zealand, had also obtained some of this breed of cattle from New South Wales, and the settlers of those early times, after the lapse of half-a-century, were still full of their praise as a valuable general purpose breed of cattle, and were fond of relating the high estimate the more recent settlers of the late fifties had of their milking capabilities, and the prices the old settlers found they could get for such as they had for sale.

The Celtic characteristics of those New South Wales cattle may have been derived from the cattle imported in large numbers from South America of Spanish descent. If this theory of the Devon and other British Celtic herds holds good, it must in a great measure apply to Spanish cattle; Spain having had just the same experience and contact with Phœnician colonists and traders as Cornwall. The antipathy displayed on the first contact of Saxon and Celt, together with the inaccessible nature of the mountainous country to which the Celts withdrew themselves and their cattle, may have had a tendency to secure a greater purity to the British Celts of the type and qualities imparted through long ages of scientific breeding. Still, we would expect some trace of this common origin in the Spanish cattle, however modified it may have become by a possibly greater admixture of blood from cattle of a different origin.

Comparing the Saxon and Celtic tpyes, we at once realise a vast difference, but it is only in view of comparatively recent discoveries and sources of knowledge that we are able to apprehend the immense time that must have elapsed since the wild white cattle of Europe (the evident origin of Saxon types) and the wild black cattle of Africa (as evidently the origin of the Egyptian reds) first branched off from some primeval ancestor.

Creamery Calculations on the Basis of Butterfat.

F. L. KENT, dairy instructor of the Oregon Agricultural College, gives the Tacoma *Dairyman* an interesting explanation which is calculated to meet the confusion in the minds of many who deliver milk to creameries, as to why their returns are based on butterfat instead of upon merchantable butter:—

"To illustrate the fairness of payment on the basis of fat delivered, take an example: Suppose a creamery has received during a month, from all patrons, such an amount of milk as will produce 3,846 lb. of butterfat. Suppose, also, that this fat has produced 4,487 lb. butter, which has been sold and netted the company, after all expenses of making, marketing, &c., have been paid, the sum of \$538·44. Now, if payment is made with the butterfat as a basis, the price to be paid per lb. will be the quotient arising from dividing the net proceeds (\$538·44) by the number of pounds of butterfat received (3,846 lb.); \$538·44 ÷ 3,846 = 14c., the price to be paid per lb. for the butterfat. But if payment were paid on the basis of the pounds of butter made, the price per lb. would be determined by dividing the net proceeds (\$538·44) by the number of pounds of butter made (4,487); \$538·44 ÷ 4,487 = 12c., the net value of the butter per lb. The overrun in this case would be $\frac{1}{6}$ or $16\frac{2}{3}$ per cent. (4,487 ÷ 3,846 = $1\frac{1}{6}$).

"Now, suppose C has delivered to the creamery during the month 3,150 lb. of milk testing 4 per cent. Then 3,150 lb. × ·04 = 126 lb., the amount of butterfat he has delivered. Then 126 × $1\frac{1}{6}$ = 147 lb., the amount of butter C's milk would make. Now, supposing the creamery is paying on the butterfat basis, the amount of C's cheque would be 126 lb. × 14c. = \$17·64. But if payment were made on the basis of the amount of butter the milk would make, his cheque would be 147 lb. × 12c. = \$17·64.

"The purpose of the above figures is to show that while the cheque, under the butterfat method, calls for a less number of pounds than it does under the actual butter method, the price in the former case is enough higher than it is in the latter to make the amount of the cheque the same in each case. The advantage of paying on the basis of the butterfat delivered rather than the actual butter is that the former is simpler, hence saves time and liability of errors, both of which are important, especially where the buttermaker has the bookkeeping to attend to."

Dairy Notes.

HOW TO RAISE A DAIRY CALF.

MR. C. P. GOODRICH, a recognised authority, says: "The business of a dairy cow is to consume and digest and turn into milk large quantities of milk-producing food, and the more of this kind of food she is able to consume and utilise the more profitable she is as a dairy cow. The ability of an animal to consume and utilise any particular food element is increased by early education and use. . . . . This same kind of food that will produce the largest quantity of milk is the very kind of food that will build up the calf's frame—that is, make it grow rapidly, if fed in the proper quantities. The calf should never be made very fat and beefy, for this will induce a beef habit that will be likely to cling to it through life, so that when it becomes a cow and is fed high to increase the milk production, the chances are that part of it will be turned into beef. The heifer calf that runs with its mother and takes all the whole milk it wants for some months, will become fat and be permanently injured for the dairy. Skim-milk, being a protein food, is much better to develop the dairy qualities. My way of feeding is this: For the first week feed its mother's whole milk. After that have part skim-milk, gradually increasing the proportion till by the time it is twelve days old, all the milk is skimmed. Feed from 12 to 16 lb. a day according to the calf's capacity—always sweet and warmed to blood heat. It is better to feed three times a day, though twice a day may do. Be careful about overfeeding on skim-milk when the calf is young. It will not do to feed any more when the milk is skimmed than if it were not skimmed. A little oil-meal or flax seed-meal, about a spoonful to a feed, made into a gruel, is put into it to make up for the fat that has been taken off from the milk. When the calf is two weeks old it will begin to eat a little good clover hay, and at about that age it can be induced to eat a little whole oats, bran, or middlings. Keep up the skim-milk feed until the calf is seven or eight months old, increasing the amount of milk somewhat, and at the same time give all of the hay, oats, bran, &c., it will eat. It is better, until the calf is four months old, to feed hay with the milk instead of pasture grass. When the calves fed in this way are eight months old they are as large as ordinary yearlings, with large frames and a large capacity for consuming food, but they are not fat. I never feed corn-meal to calves, neither do I feed timothy hay if it can be avoided, because these are fattening foods. I am determined to avoid fattening up an animal designed for the dairy, for in my past experience I have seen too much of the evil effects of such a course of feeding."

There is a valuable lesson in those remarks for Queensland dairymen and stock-raisers generally, if it is only taken in the right way. The proper treatment of the heifer calf is the first step towards getting cows that will give an average of 300 lb. of butter in the year. Let our dairy people make up their minds that until they can show an average return of from 250 to 300 lb. of butter from their herds, they cannot claim to be successful. To get this they have a lot to learn, and we fear that the danger is not of overfeeding and fattening their heifer calves, but of starving and stunting them. Mr. Goodrich's advice to feed clover hay may be substantially followed by feeding good lucerne hay or chaff instead. We do not grow oats for grain, but bran is always obtainable. Now, who will be the first to test the soundness of Mr. Goodrich's great experience in its application to Queensland?

Mr. Goodrich is one of the most notably successful dairymen in America, and is a liberal contributor to the Dairy Press in that country. His statements as above quoted are taken from an article contributed by him to the *Prairie Farmer*.

No. 1.—GRANT OF SEAFIELD. No. 2.—CHIEF. No. 3.—DUKE OF CONNAUGHT.

BRED BY JOHN GRANT, OF TULLAMARINE. BRED BY MESSRS. HYNTZ BROS., BALLARAT.

College Dairy Herd Bulls.

Fruit Culture in Queensland.

By ALBERT H. BENSON,
Government Fruit Expert.

Before proceeding with the important question of drainage, I wish to refer briefly to my last paper on "Fruit Culture," in the August number of the *Agricultural Journal*, as I find that, when dealing with the preparation of the soil for the orchard at the Westbrook Experiment Farm, I have omitted to mention the nature of the soil, as this, of course, determines to a great extent the kind and strength of ploughs to be used and the power required to do the work. The soil shown in the illustration of breaking and subsoil ploughs at work is a dark-brown, strong volcanic loam, more or less stony, that scours badly, but which, if worked at the right time, can be reduced to a fine tilth. The subsoil is more gravelly, with a substratum of rotten basaltic rock, insuring a good drainage when once subsoiled. The land also has been recently cleared of green timber, so that, taking this and the nature of the soil into consideration, heavy implements were absolutely necessary to do the work; in fact, I question the advisability of using anything lighter on the Darling Downs for this work; though on the light sandy loams of the interior, or the sandy or light alluvial loams of the rivers and coastal districts, much lighter tools can be used, provided that the land is free of stumps and roots. In free, sandy, loamy soils, subsoiling is not a necessity, though always beneficial; but where the subsoil is impervious or forms a hard pan, it is of the first importance

DRAINAGE.

No soil is suitable for fruit culture in Queensland unless it has good drainage; and if naturally deficient in drainage, then it must be artificially drained before it is fit to grow fruit. When speaking of soils suitable for fruit culture, I emphasised the necessity of selecting those possessing good natural drainage, and stated the reasons for doing so; but such soils are not always available in all districts, so that less suitable ones have to be chosen by those wishing to grow fruit in such districts, and these less suitable soils must be artificially drained. Drains are of two kinds—open drains, and sub or underground drains; and both are used by orchardists.

Open Drains.—These answer two purposes: First, they enable the surface water to be rapidly carried off; and, secondly, they are of considerable value for intercepting seepage water from higher land. Open drains should be constructed wherever required to carry off surface water, and their size and depth will entirely depend on the quantity of water they have to carry. Where the quantity of water to be carried is only small, then they can be most cheaply constructed with a plough, a man following the plough with a long-handled shovel to throw the loose dirt out of the furrow; but when they are required to carry more water, although the plough can be used to advantage for removing the surface soil, the bulk of the work has to be done by hand. In open drains don't be afraid to make them too big or too wide for their depth, as it is always advisable to give them a good batter—at least 1 in 3—as there is then little chance of the sides falling in. Deep, open drains form good outlets for the subdrains, and when used for this purpose should always follow the natural watercourse, which is usually where the fall is greatest. Ordinary

surface drains should not be too steep, or they will be likely to wear into deep channels, and large quantities of soil will be lost. Where permanent open drains wash badly, checks or blocks of timber or brush should be inserted in them at intervals, and buffalo-grass or common couch should be planted to retain the soil. Deep, open drains will be found of considerable value as cut-off drains to intercept seepage water coming from higher ground, which would otherwise soak through the orchard and injure the trees planted in it. This damage by seepage water is common after very heavy and continuous rains, and is noticeable in many parts of the colony in soils and situations that are apparently very well drained; and since it is often several months after the rain before the injury resulting from the seepage shows itself in the trees, the cause of the injury is often overlooked. Such drains should be placed on the higher side of all orchards that have higher land lying to the back of them, and they will be found to be of great value during very wet spells.

Sub or Underground Drains.—There are many methods of underground drainage, and various materials are used for the construction of the drains, such materials including logs, brush, slabs, stones, &c.; but the best, cheapest, and most efficient drains are constructed of round drain tiles of sizes to suit the quantity of water to be carried.

Log Drains.—Where timber is very plentiful, drains may be constructed of round logs, two logs being placed in the bottom of the drain, leaving a space between them, and a third log is used as a cover, the earth being prevented from filling up the space between the logs by means of a good blinding of small branches, &c. Such drains need to be of considerable size, and are consequently expensive to dig. I do not recommend them, or, in fact, *any* timber drain for orchard purposes, as the rotting of the timber is apt to produce root-fungus in any fruit trees that are planted near to the drain.

Brush Drains.—Place the coarser brush or branches in the bottom, and blind with finer brush. The drains should be not less than 3 feet deep and 1 foot wide at bottom, and should be filled with at least 18 inches of brush. Brush drains, if well made, answer well in spuey, sandy, or boggy country, but do not last any length of time.

Slab Drains.—The slabs can be placed in a similar manner to the stones in the box and coupled drains shown presently, the slabs being well blinded with brush.

Stone Drains.—There are many kinds of stone drains, of which the simplest is a plain drain 3 feet to 3 feet 6 inches deep, 7 inches wide at bottom, and the drain filled to a depth of 15 inches with cracked or land stones not exceeding 3 inches in diameter (Fig. 1). This mass of stones should be blinded by a thin layer of smaller stones, or by a layer of fine brush such as tea-tree.

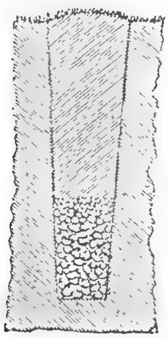


FIG. 1.—*Broken Stone Drain.*

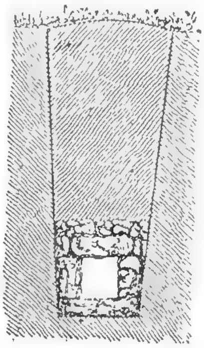


FIG. 2.—*Box Drain.*

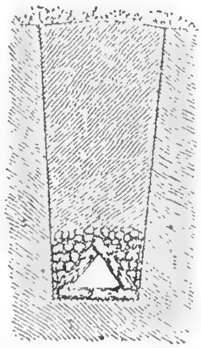


FIG. 3.—*Coupled Drain.*

There are also two forms of built stone drains, of which the box (Fig. 2) and coupled (Fig. 3) drains, shown herewith, are examples. The drawings of drains and draining tools are taken from Morton's Encyclopedia of Agriculture, and though the original drawings were made many years ago they are, in my opinion, well worthy of reproduction. All of the above kinds of drains are expensive, in that the labour necessary to construct them is very considerable, but they have this advantage: That the materials can be obtained free of cost, so that when the orchardist does his own work he is not put to any outside expense. Such drains are therefore of value to a selector, to whom the purchase of drain tiles would be too great an expense, but to anyone who can afford it, draining with tiles is far the cheapest and most satisfactory method.

Tile Drainage.—The great advantage of tiles over stones or other materials is that when they are used no more soil is moved than is absolutely necessary, the bottom spit being taken out of such a width as will admit of the tile being laid, but no more; thus the cost of digging them is very much less—in fact, the cost of the drain tiles is more than saved in the difference in the cost of digging the drains. Tile drainage, to be a success, requires, however, to be done by men who thoroughly understand their business, and the bottom of the drain must be finished in such a manner that there are no inequalities, and that there is a steady and even fall in one direction; so that when the tiles are laid they shall join well and there shall be no sagging in the line, as a sag or sudden depression will soon silt up and the drain will become worse than useless.

FIG. 4. FIG. 5. FIG. 6. FIG. 7. FIG. 8. FIG. 9.

Several special tools are used for tile drainage, the spades being of such a width and shape that they will take out the soil easily and cleanly, and that they will not take out more than is absolutely necessary. The spades (Figs. 4 and 5) are of various widths, and are often rounded so as to hold the earth better. The bottoming tools (Figs. 6, 7, 8, and 9), which are either straight or rounded, preferably the latter, are used for taking out the bottom spit of 10 to 15 inches according to the soil, and are made of various widths so as to suit the size of tiles that are used.

In order to clean out and prepare the bottom of the drain for receiving the tiles, a special tool called a bottom - smoother (Fig 10) is used, and a special tool is used for laying the tiles (Fig. 11). In order to regulate the depth and width of the drains, special drain gauges are used (Figs. 12 and 13). Illustrations of all of these tools are given herewith, and will not need special explanation.

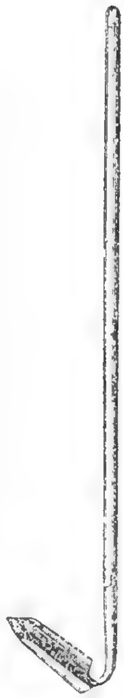


Fig. 10.


Fig. 11

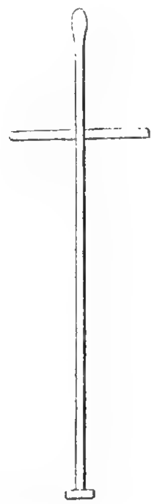


Fig. 12

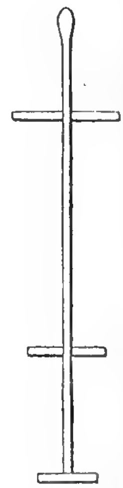


Fig. 13.

The following illustrations show a round drain tile (Fig. 14), which is the shape always used now, and the section of a shoulder tile-drain (Fig. 15) showing the tile in position and the last spit that as been taken out by the bottoming tool. The drain tiles are laid end to end, no especial trouble being taken to keep the joints close, though the tiles should always be well and evenly laid. When the tiles are laid, the drains may be either filled in at once, or, if wished, a little blinding of rough grass or small brushwood may be placed on the top of the tiles before the earth is filled in.


Fig. 14.

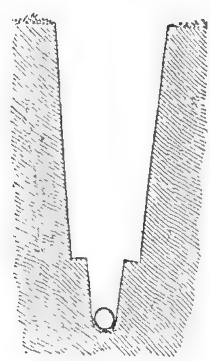


Fig. 15.

The depth at which the drains should be dug and the distance that there should be between the drains depend entirely on the nature of the soil, as in heavy soils the drains should not exceed 3 feet in depth, or from 18 to 20 feet apart, for if placed at a greater depth, or at a greater distance apart, either the water would not get down to the drains, or else the latter would not draw the whole of the water from the land, all land outside of 9 or 10 feet from the drain on each side being outside the influence of the drain. In freer soils the depth may be increased, and as the depth is increased so may the distance between the drains be increased, but the size of the tiles should be increased as well. Draining 4 feet deep and 30 feet apart is about the limit of efficient drainage in any soil, as, if the drains are placed at greater distances apart, there is more or less land beyond the influence of the drain, which is consequently undrained. There is another common mistake in tile drainage, and that is, the use of too small drain tiles. Two inches inside diameter is the

smallest size that should be used under any conditions, and where the drains are of any length, say over 100 yards, before being connected with the main drain or outlet, the size of the lower tiles should be increased to at least 3 inches. For main drains, tiles of 4, 6, or 8 inches diameter are used, the size of the tiles depending on the extent of the ground to be drained. Tiles of larger size than this are not required except in very extensive drainage operations. Where a large area of land is to be drained in any one district it will be found to be much cheaper to make the tiles on the land to be drained, if there is any suitable clay available, as a pug-mill and tile-making plant do not run into a very great amount, whereas the cartage and freight on drain tiles obtained from a distance soon become a heavy item when there is a considerable quantity of draining to be done.

Effects of Drainage.—The effects of drainage may be briefly summarised as follows:—

1. Drainage removes the superfluous moisture from the soil, and facilitates cultivation, so that drained land can be worked sooner after rain than undrained land.

2. Drainage removes stagnant water, and prevents the accumulation of same round the roots of fruit trees or plants, so that the roots are able to develop healthily.

3. Drainage increases the absorptive properties of the soil, so that drained soils retain moisture better during a prolonged dry spell than undrained soils.

4. Drainage warms the soil, as undrained land is always colder than drained land, owing to the excessive surface evaporation from such soils, such evaporation cooling the land. Undrained soils always freeze sooner than drained soils, undrained land being sometimes white with hoar frost, when drained land adjoining is practically free from frost.

5. Drainage ærates the soil, as the space occupied by water before drainage is occupied by air afterwards, and this air in the soil acts directly in disintegrating the soil and consequently in liberating plant food for the use of the trees or plants growing in the soil; a thorough æration of the soil is also essential to the healthy development of all plant growth, as, unless the roots are supplied with plenty of air, the plants are never healthy or vigorous.

6. Drainage renders the land more friable, and consequently less expensive to work.

7. Drained land responds to the application of manure much more readily than undrained land, and the results of the manuring are more apparent. In the case of very soluble manures, however, a large quantity of manurial matter is apt to be carried off by the drains after heavy rains, so that such manures should not be applied in large quantities at any one time to well-drained soils, but should be applied in small quantities, when the plants or trees actually require them—that is to say, during a period of active plant growth.

In drainage there are several points that are worthy of especial mention, and which should always be carefully attended to:—

1. Whatever drainage has to be done, see that it is *well* done, as bad drainage is often worse than no drains at all.

2. See that the tiles are well laid, and the drain has a regular fall.

3. When blinding is used, see that it is carefully done.

4. See that the drains are well filled.

5. Have your main drains at least 6 inches deeper than the side or other drains, and be careful to make a neat opening in the top of the main drain, where the side drain runs into it.

6. See that the water from the side drains runs into the main drain in such a manner, and at such an angle, that it will not check or otherwise interfere with the flow of water in the main drain.

7. See that the outlets of all main drains are kept open, and that there is a good get-away for all water coming from the drains. The open drain or other watercourse into which the drains empty should be kept in good order, and should not be allowed to become choked up with weeds or silt. If the mouth or outlet of a main drain is blocked, the whole drainage system connected with the blocked drain will soon silt up and become worthless; so that the outlets of all main drains should always be kept clear.

Further Notes on Pomelos.

J. E. CUTTER, of Riverside, at the recent meeting of the Southern California Pomological Society, gave an address on "Citrus Specialties," introducing an interesting review of the pomelo proposition:—

"*Raison d'Etre.*—Among specialties, most interest is now centring in the pomelo, or grape fruit, as more generally known. The fruit had found its way from the groves of Florida to the favour of eastern consumers before the great freezes of 1894-95 cut off the supply. How strong, though perhaps limited, that favour had become, the large prices of present years show. While the fruit is of recognised value for medicinal purposes, it also seems to suit the palates of those who want something tonic with their food. With such the 'grape fruit habit' is easy to learn, and its continuance is a pleasing indulgence (especially for the man with a bearing grove just now).

"*Varieties.*—Since public demand had decided the desirability of the culture of the pomelo, we turn next to the question of varieties. The industry is so new at this date no one is, or can be, an authority; but varieties, as candidates for preference, are numerous. Already we hear of Aurantium, Leonardy, Bowen, Triumph, Seedless, Walters, Thornless Silver Cluster, Imperial, Mays, and the ever-present seedling. Most of these 'varieties' are as indistinct in characteristics as seedling oranges, and the points of distinctiveness which some of them possess are those of positive disadvantage.

"*Size.*—As the markets prefer 42's to 64's, it follows that the Triumph and the still smaller Walters, with Mays, are plainly deficient in respect of size. The lastnamed is reported from Florida as running from 60 to 100 per box; 64's to 96's in our California boxes. Seedless meets market requirements in size. The writer has fruited this variety, and finds it to be practically seedless, and best in texture and general quality. Peel rather thick (in Florida it is said to be very thin), but this may be due to my tree being still young. It has bloomed very heavily this season; in previous years had been cut severely for buds, so preventing much fruiting. It is nearly thornless, as well as seedless, and makes a beautiful tree, much better of habit than Triumph. It may or may not be the best variety, but seedlessness is certainly a definite and valuable point to gain.

"I will here remark that in the 'scale' for judging citrus fruits a penalty of one point for each five seeds should be laid, rather than that provided for oranges and lemons.

"*The Silver Cluster.*—A letter of a nurseryman appeared in the *Florida Farmer* of 27th February last, in which he states as follows of the 'Thornless Silver Cluster':—'The tree is a vigorous grower, absolutely thornless when wood is matured, and an early and abundant bearer. The fruit is medium size, thin-skinned, has very few seeds, and is an excellent shipper, packing about 46 per box. . . . In this section it is preferred to any other variety.'

"Such a combination of good points leaves little to be desired.

"*The Mays.*—Of the Mays, a Florida gentleman of high standing in matters of citrus fruits writes me:—'It has always taken premiums over all others at the fairs where I have shown it. . . . It is not as large as some—60 to 100 per box.'

"In general appearance the seedlings equal—perhaps excel—those which show distinctive points, but it would seem that their tough integuments and and the fifty or sixty seeds they carry will eventually lead to the same discrimination against them that has fallen to the seedling orange. It is certainly the part of prudence in planting to use varieties that are known to have distinctive points of excellence; but several years must yet elapse before superiority can establish the claims of any.—*Pacific Rural Press.*"

Economic Botany.

No. 1.

THE PAPAW (*CARICA PAPAYA*, LINN).

BY J. F. BAILEY.

Derivation.—The plant, which belongs to the "passion fruit" family (Passifloreæ), is said to have received its generic name on account of the foliage somewhat resembling that of the Common Fig (*Ficus carica*). In India Papaya or Papiya is the general name of the plant. Rumphius, a great authority on Indian botany, suspected that it was originally brought from a district called Popaya, in Peru; hence that name came to be applied to it.

Description.—The tree generally grows to a height of about 20 feet, is as a rule unbranched, although sometimes it will throw out numerous branches; wood spongy. The leaves are spreading, often a foot or more long, petiolated (stalked), and cut into seven oblong, sinuated, and almost pinnatifid lobes, the middle one of which is usually the longest and most divided; smooth on both sides, dark-green above and marked with much ramified, pale veins, beneath much lighter coloured with prominent veins. Petiole (stalk) of leaf 1 or 2 ft. long, smooth, cylindrical.

The plant is polygamous, that is to say there may be male, female, or hermaphrodite flowers on the same or on distinct plants. This does not seem to be generally understood in this colony. The male flowers are usually in long scantily branched axillary panicles, but at times these panicles are very short. The female flowers in most plants of the papaw are found close to the stem in the axils of the leaves, but are sometimes produced at the extremities of the abovementioned panicles. The fruit is oblong, and more or less furrowed; the size of a small melon, yellowish when ripe, and containing a number of round, grey, slimy seeds, which resemble in flavour the fruit of the common garden *Nasturtium*. Every part of the plant exudes a milky juice in abundance.

Cultivation.—The papaw-tree is of rapid growth, and has been known to fruit in this colony in ten months from the sowing of the seed. In North Queensland it has strayed from cultivation and become naturalised in the scrubs, where it bears fruit in abundance. When grown in Southern Queensland it should be given rich soil and a sheltered situation, for in winter it is apt to be seriously affected by frost and cold winds. It is readily propagated from seed, which should be sown, say, about September in a bed, formed of rich compost, in a sheltered part of the garden. The seedlings when they have attained the height of about 6 to 9 inches may be removed to their permanent positions; choose dull cloudy weather for this operation. It is better to plant close, say 6 feet or so apart, which would allow thinning out, at the first flowering of the young trees, those bearing the long panicled flowers, which are mostly male, the female flowers, if any, on such producing worthless fruit. If each young seedling, when planted out, could be shaded with a small bough and given a light mulch, it would be an advantage. In clearing away weeds great care must be taken not to injure the stems.

Uses.—The papaw is largely used in all tropical countries, and is rightly considered one of the most wholesome of fruits.

As a medicinal plant it is particularly deserving of notice. According to Dymock, the anthelmintic properties of the milky juice were first noticed in the seventeenth century by Hernandez, and the attention of the medical

profession in India was called to it by Dr. Fleming in the year 1810. The following mode of administration employed by the late Dr. Lemarchand, of Mauritius, is recommended:—Take the fresh papaw juice, honey, of each a tablespoonful; mix thoroughly, gradually add three or four tablespoonfuls of boiling water, and when sufficiently cool take the whole at a draught, following its administration two hours subsequently by a dose of castor oil, to which a portion of lime-juice or vinegar may be added. This may be repeated two days successively if required. The above is a dose for an adult; half the quantity may be given to children between seven and ten years of age; and a teaspoonful to children under three years. If it cause griping, enemas containing sugar have been found effectual in relieving it. . . . The author of the Makhzan says that it is a remedy for bleeding piles and ulcers of the urinary passages; and is also useful in dyspepsia; rubbing the milk in two or three times cures ringworm, or psoriasis, causing a copious serous exudation attended with itching. Evers has employed the milk in the treatment of splenic and hepatic enlargements with good results; a teaspoonful with an equal quantity of sugar divided into three doses was administered daily.

Christy, in his "Commercial Plants and Drugs, No. 8," quotes a case in the West Indies where a sufferer from a violent attack of gall-stones, being far away from medical aid, tried half-a-teaspoonful of the milk of the green papaw twice daily, with the result that in three days the pains had entirely left him.

Papain.—The active principle of the juice is called Papain, and is now an article of commerce for medicinal purposes, and is said to be capable of digesting 200 times its weight of fibrine.

The *Chemist and Druggist* gives the following simple method of manufacturing papain:—"The juice is pressed out of the fruit, clarified by filtration through a twill bag, and the ferment precipitated by alcohol. It is then dried, but is sometimes purified by treatment of water."

A French physician (Dr. Bartholow), in 1895, tried papain in an obstinate case of tapeworm which had resisted all other methods of treatment. Doses of about ten grains were given three times daily, after each meal. Papain exerts a toxic action on the parasite.—*La Médic. Mod.*

The *Pharmaceutical Journal*, 25th May, 1895 (quoting from *Journ. des Mal. Cutan. et Syph.*, Feb. 1895) states that "Papain is administered in the following pigment in ichthyosis, or fish-skin disease. Papain, 8 parts; salicylic acid, 4 parts; glycerin and castor oil, of each 16 parts."

Chemical Composition.—Herr Wittmack, according to Dymock, examined the properties of the milky juice, with the following results:—He obtained, after repeated incision of a half-ripe fruit, nearly 2 grammes of white milky juice of the consistence of cream. This dried on a watch-glass to a hard vitreous white mass, having what appeared to be greasy spots on the surface, but what really were flecks of a gelatinous substance that always adheres to the more hardened material. The microscope showed it to be a fine grumous mass, containing some large particles and isolated starch grains. Iodine coloured the juice yellowish-brown. A portion of the juice was dissolved in three times its weight of water, and this was placed with 10 grammes of quite fresh lean beef in one piece in distilled water, and boiled for five minutes. Below the boiling point the meat fell into several pieces, and at the close of the experiment it had separated into coarse shreds. In the control experiments made without the juice, the boiled meat was visibly harder. A small piece of beef wrapped in a papaw-leaf during twenty-four hours at 15 C., after a short boiling, became perfectly tender; a similar piece wrapped in paper, and heated in the same manner, remained quite hard.

Collecting the Juice.—A good price can always be obtained for papaw juice. Some time ago a London firm was offering 10s. per lb. for it, and were prepared to take considerable quantities.

The preparation is very simple. The unripe fruit has to be scarred or lined some ¼-in. deep with a sharp knife daily, and the juice caught and dried upon sheets of glass, when it becomes at once a marketable product.

Botany.

CONTRIBUTIONS TO THE FLORA OF QUEENSLAND.

BY F. MANSON BAILEY, F.L.S.,
Colonial Botanist.

Order LEGUMINOSÆ.

ERYTHRINA, Linn.

E. insularis, *Bail.* (n. sp.) A spreading-headed tree about 15 to 20 ft. high, bark light-coloured, smooth, the trunk and branches unevenly round, giving the idea of a hard wooded tree; the ends of the branches or branchlets slightly velvety as well as the foliage, but being late in the season most of the leaves had fallen at the time these specimens were obtained; could not find a single prickle upon the tree from which the seeds were obtained, but upon another tree upon which some few leaves still remained were a few pairs of minute mahogany-coloured ones. Leaves smaller, but very similar to *E. indica*, or between that species and *E. vespertilio*, Benth. No flowers seen. Fruiting raceme 3 or 4 in. long upon a peduncle of about 6 in., pods crowded, pedicels 1 in. long, solitary or 2 or 3 together. Pods seldom exceeding 5 or 6 in., abruptly terminating in a prominent recurved point, at the base a more or less portion is seedless and much narrowed, the rest of the pod almost moniliform the contractions between the seeds very irregular, often long and narrow. Seeds red, subovate, about 5 lines long, persistent after the opening of the pods.

Hab.: Turtle Island, June, 1897.

Order PASSIFLOREÆ.

MODECCA, Lam.

M. populifolia, *Blume*, Rumphia i. 168, t. 50. A glabrous climber, extending some distance over adjoining shrubs and trees; stems striate, scarcely sulcate. Leaves cordate, ovate-acute, membranous, 4 to 5 in. long, 2 to 3 in. broad near the base; petiole about 1 in., with two apical glands. Peduncles rather long and slender, terminating, as in *M. australis*, in a rather strong tendril, at the base of which are a pair of small opposite pedunculate cymes. (No flowers on the specimens examined.) Fruit stipitate, 3½ in. long, tapering to both ends, of a rich crimson. Seeds lenticular, 3½ lines diameter, dark-brown and deeply pitted.

Hab.: Ranges about Trinity Bay, *E. Cowley, L. J. Nugent, and Mrs. A. Taylor.* Also indigenous in Tropical Asia.

Order CAMPANULACEÆ.

LOBELIA, Linn.

L. Douglasiana, *Bail.* (n. sp.) Stem mostly erect, about 6 in. high, angular. Leaves 6 to 9 lines long, distant, sessile, linear, with distant sharp marginal teeth. Flowers violet, on filiform peduncles of about 2 in. Calyx-tube 10-ribbed, each alternate or intermediate rib ending in a gland-like tooth between the proper lobes. Corolla-tube slender, lobes narrow, the 3 lower ones white marked with 2 green lines, inside of tube glandular at the base. Anthers bearing bristles near the top.

Hab.: On damp land, Thursday and Hammond Islands, Torres Straits.

Order APOCYNACEÆ.

OCHROSIA, Juss.

O. Cowleyi, *Bail.* (n. sp.) A large shrub or small tree, branches in whorls of 5, the stem more or less swelled about their insertion. Leaves in whorls of 5 oblong-cuneate, shortly acuminate, from 8 to 12 in. long and nearly 5 in. broad, parallel transverse veins, about 20 on each side of the midrib. Flowers on abortive branches which form elongated panicles on the stem at the branch whorls. Calyx-segments imbricate, unequal. Corolla cream-coloured, tube about 4 lines long, lobes about the same length, narrow-falcately curved, auricled at the base. Anthers attached near the top of the corolla-tube. Stigma enclosed in the corolla-tube. Fruit (those observed not ripe) green, elliptic-oblong, 3 in. long, with a short recurved or hooked point, the endocarp developing into erect, closely appressed, rootlike processes.

Hab.: Dalrymple Island, from where *Mr. E. Cowley* brought the plant now flowering at the Kamerunga State Nursery. The tree is of handsome habit and worthy of cultivation.

ALSTONIA, R. Br.

A. somersetensis, *Bail.* (n. sp.) A rather large tree. Leaves 6 to 9 in. long, 2 to 3 in. broad above the middle, in whorls of 4, obovate-lanceolate, shortly acuminate, tapering from above the middle to rather thin petioles of from ½ to 1 in., with about 20 parallel transverse veins on either side of a prominent midrib. Inflorescence not seen, the follicles picked up beneath the trees 1 ft. or more long.

Hab.: Near Mr. Jardine's house, Somerset. This species is probably nearly allied to *A. macrophylla*, Wall., in Hook. Flora of British India.

PARSONSIA, R. Br.

P. nesophila, *Bail.* (n. sp.) A tall climber, the young growth, and inflorescence, clothed with rust-coloured hairs. Leaves oblong-cordate, 4 to 5 in. long, 2 to 3 in. broad on petioles of about 1 in. Peduncles 3½ in. long, very shortly forked at the end, each branch bearing a few closely crowded flowers. Calyx-segments 1 line long, recurved. Corolla-lobes slightly overlapping, yellow, orifice of short-tube hairy. Hypogynous scales 2-lobed. Stamens inserted near the base of the corolla; filaments not twisted, hairy, flat. Anthers nearly as long as the corolla, basal lobes prominent. Fruit 5 or 6 in. long, narrow, hard and tardily separating.

Hab.: Thursday Island. Nearly allied to *P. velutina*, R. Br.

Order ASCLEPIADEÆ.

HOYA, R. Br.

H. Sana, *Bail.* (n. sp.) A slender climber, on open country found climbing over shrubs to the height of 6 or more feet. Leaves oblong to oblong-lanceolate, from 1½ to 3¼ in. long, thick, pale in colour, only showing a rather broad midrib, more or less covered on the underside with white hairs, often apiculate, petioles seldom exceeding ½-inch. Peduncles hairy, about 10 lines long, bearing an umbel of about 10 or 12 more or less pubescent, white flowers. Pedicels hairy, 9 lines long. Calyx-lobes 5, hairy, rather narrow. Corolla spreading to about 5 lines diameter; lobes 5, hairy on the back, the hairs much shorter on the face. Corona-segments expanding into concave, ovate, horizontally spreading laminæ, the base ending in a rather long point; the 2 keels almost wing-like.

Hab.: Polo Creek, Somerset. This new species is a very pretty slender climber; quite worthy of garden culture. The name is after Mrs. F. L. Jardine, who during my stay at Somerset pointed out to me the present and many other interesting plants of that locality.

Order ACANTHACEÆ.

ASYSTASIA, Blume.

Calyx deeply divided into 5 narrow segments. Corolla-tube short or long, funnel-shaped, ventricose or narrow; lobes 5, subequal, imbricate in the bud. Stamens 4, all perfect, didynamus, subequal; anthers oblong, cells parallel, approximate, base minutely spurred or submuticus, the points only obscurely whitened. Ovary 4-ovulate, very hairy; stigma minutely bifid or subcapitate. Capsule elliptic, 4-seeded, base contracted, solid. Seeds compressed, orbicular or irregularly angular, rugose or tubercular, glabrous. Herbs or undershrubs, with entire leaves. Spikes or racemes lax or dense, simple or compound, 1-sided or suberect; bracts and bracteoles linear, usually shorter than the calyx; flowers opposite or alternate, usually solitary, blue, purple, rose, or yellow. The species of this genus are met with in Tropical Asia and South Africa, but not to my knowledge in Australia until I met with the species, here described, on Thursday Island.

A. australasica, *Bail.* (n. sp.) A rather straggling plant about 18 in. high, slightly branched, stems somewhat erect. Leaves membranous, 4 or 5 in. long, 2½ in. broad, with a long abruptly acuminate point, rounded and slightly decurrent on the petiole which is slender and often nearly 2½ in. long. Flowers lateral, distant, pale-bluish, in terminal racemes of 2 or 3 in., pedicels about 3 lines; calyx-tube short, lobes very narrow, about 3 lines long. Corolla-tube ½-in., expanding upwards, lobes rather short and rounded. Stamens 4, in pairs, not exserted, style about the length of the stamens. Capsule seedless in the lower half, the apex rostrate, seeds 4 in the centre of capsule, prominently tuberculose on each face, the margins sinuate, 2 lines diameter.

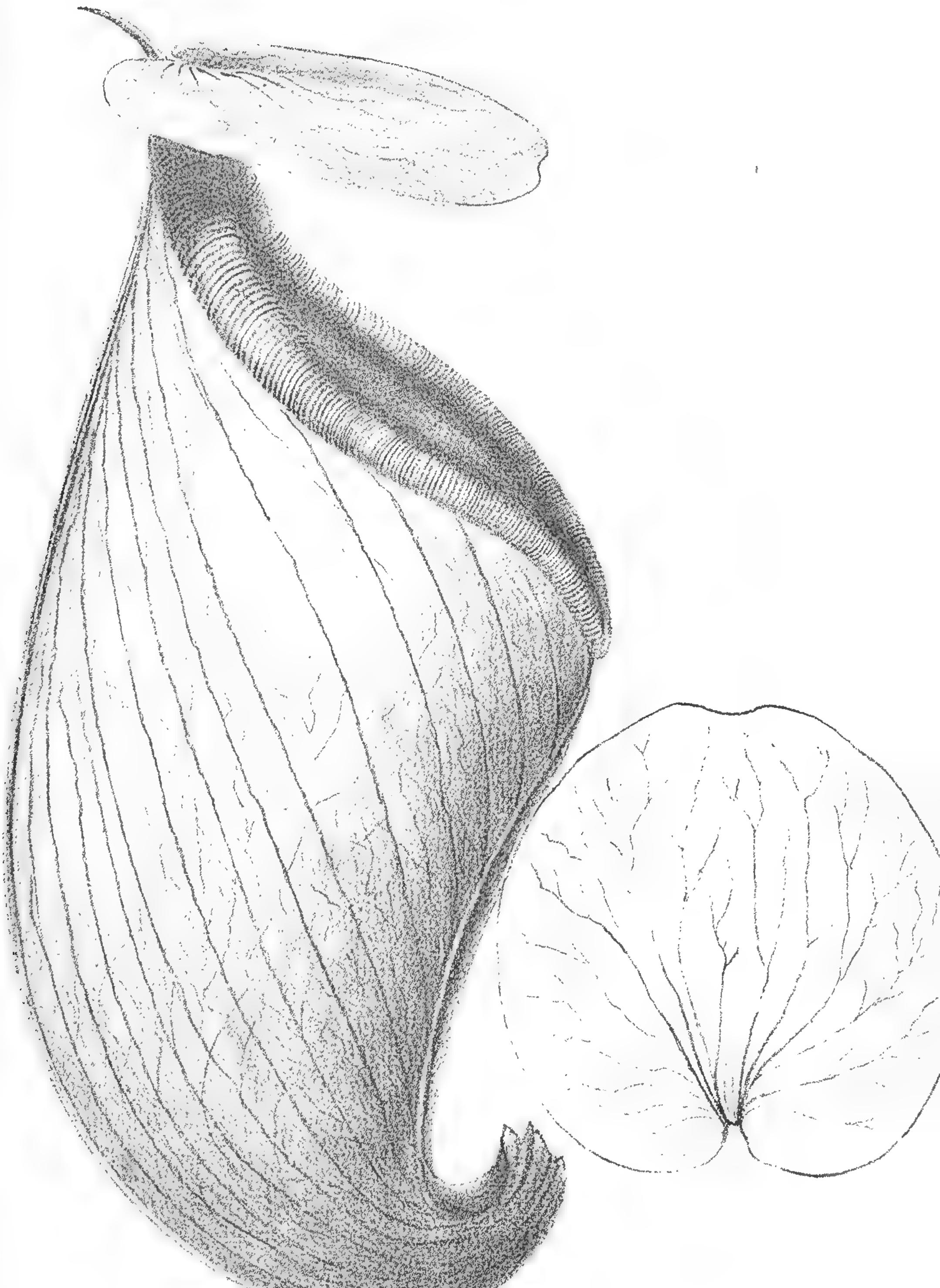
Hab.: Thursday Island, Torres Strait. Under tree in the gullies between the hills. This Australian species somewhat resembles *A. coromandeliana*, Nees.

Order NEPENTHACEÆ.

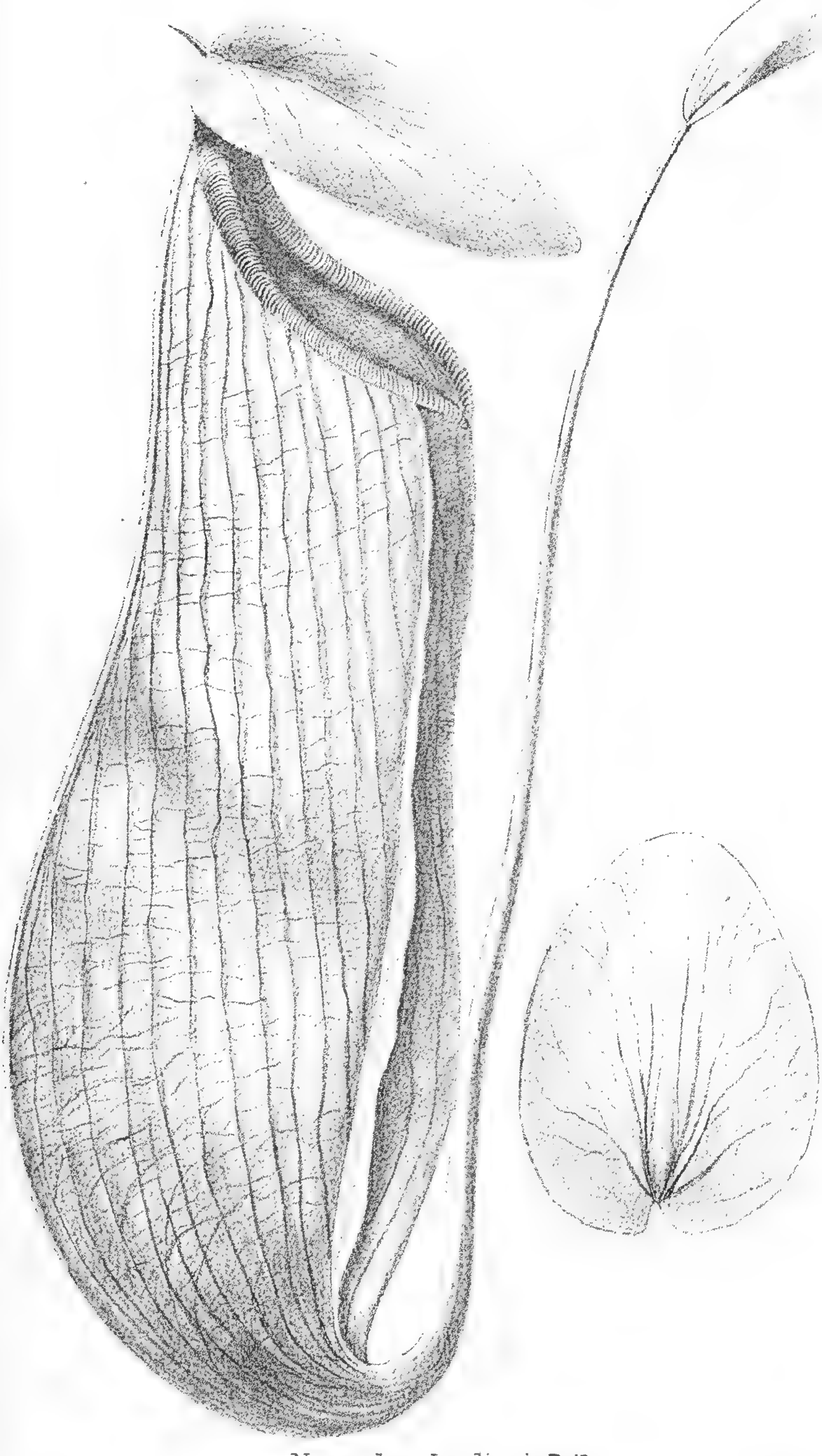
NEPENTHES, Linn.

N. Jardinei, *Bail.* (n. sp.) (After Frank L. Jardine.) Stems several, rather stout, arising from a hard knotty rhizome, 2 to 3 or more felt high; not climbing, sometimes branched, clothed with leaves mostly bearing pitchers; the young growth more or less clothed with soft hairs, the shorter ones of which are usually stellate, the longer ones frequently simple. Leaves decurrent and slightly stem-clasping; petiole 2 in. long winged; lamina 8 in. long and from 2 to nearly 3 in. broad in the middle, tapering towards each end; midrib at first purplish-red, longitudinal nerves on each side of midrib usually 6; the narrow portion or stalk of pitcher about 6 in., without the loop of *N. Kennedyi*, F. v. M.; pitcher 5 to 7 in. long, 1¾ in. diameter near the top, enlarging in the lower half to about 2½ in, with numerous prominent longitudinal nerves and reticulations; anterior ribs with narrow red wings; orifice wide and arising towards the spur; peristome narrow, about 1 line broad, with numerous transverse veins; posterior spur recurved; operculum elliptical, about 2 in. long, with numerous various-sized circular glands on the inner surface; inside of pitcher more or less spotted or stained purplish-red. Racemes dense, 4 to 8 in. long in the males, but shorter in the female racemes; male perianth of 4 oval segments, about 3 lines long, reflexed upon the pedicel, united and forming a cup at the base; staminal column about the length of the perianth-segments, head of anthers 1 line diameter. Female perianth like the male, stigma sessile. Capsule coriaceous, ¾-in. long, 4-valved, each valve crowned by a lobe of the stigma. (*See* plate representing one of the pitchers.)

Hab.: Somerset, Cape York Peninsula, *Frank L. Jardine.*



Nepenthes Rowanæ, *Bail.*
(Nat. Size)



Nepenthes Jardinei, *Bail.*
(Nat. Size)

N. Rowanæ, *Bail.* (n. sp.) (After Mrs. Rowan, a painter of Australian flowers.) Pitchers, when fresh, beautifully marked with reddish-purple, about 6 in. long, shortly and abruptly curved at the base, from which it widens upwards, attaining a width at the top of about 3 in., prominently marked on the outside by oblique parallel nerves and reticulate veins; anterior ribs hard, scarcely winged, much nearer together than in *N. Jardinei;* orifice very wide, posterior spur flat, tomentose; peristome 3 or 4 lines broad, with close transverse veins; operculum nearly orbicular, about 2½ in. diameter, with numerous circular glands on the inner face. (*See* plate representing one of the pitchers.)

Hab: Somerset, Cape York Peninsula, *Frank L. Jardine.* A further description of this plant when the specimens promised by Mr. Jardine are to hand.

Order URTICACEÆ.

FICUS, Linn.

F. Thynneana, *Bail.* (n. sp.) (After the Hon. A. J. Thynne, M.L.C.) A rather dwarf glabrous tree, with dense spreading head, the horizontal branches extending often a distance of 30 or more feet, and emitting roots in abundance, which ultimately become additional stems of the tree (I counted twelve of such stems to one tree). Branchlets flattish-triangular. Leaves oblong, 2½ to 5 in. long, 2 to 3 in. broad, or sometimes much smaller; apex rounded or shortly acuminate, base more or less cuneate, rather pale on the under surface, lateral nerves numerous, patent, looping near the margin; petioles flattened, seldom exceeding ½-in.; stipules narrow, acuminate under ½-in. Receptacles axillary, pear-shaped, ½ to ¾ in. long, in pairs, not unfrequently joined together at the base and spreading in an almost horizontal manner from the branchlet; bracts at base 3, orbicular, 1½ to 2 lines diameter, gibbous. Perianths sessile; segments 3, oblong in the female florets, shorter and more cymbiform in the male, enclosing a single stamen; anther with 2 distinct cells, rather large; pollen smooth, globose; style, entire filiform, slightly enlarging at the stigma. (*See* plate representing a tree of this Fig, growing upon the beach at Cairns.)

Hab.: On the beach at Cairns, and locally known as the "Banyan."

Order JUNCACEÆ.

XANTHORRHÆA, Sm.

X. pumilio, *R. Br.* Caudex scarcely produced above the surface of the ground, or attaining 6 or 9 in. according to Mr. Wheatcroft. Leaves under 1 ft. long, twisted and very much recurved, flat, under 2 lines broad with the midrib prominent; scape under 1 ft. high, in the specimens to hand 5 to 9 in. long, and less than ¼-in. diameter. Spikes from ¾ to 2 in. long. Bracts 2 lines long, spathulate, green and minutely ciliate, the lower part very slender. Perianth-segments about 3 lines long, outer ones thick and glossy, green at the top, white below, margins very thin and much involute. Stamens spreading, nearly twice as long as the perianth, filaments broad; anther oblong. Style erect, thick, about as long as the perianth; stigma minute. Capsule protruding, but not matured on the specimen examined.

Hab.: *Port Curtis, John Wheatcroft, M.A.* The discovery again of this plant is of interest on account of its not having been met with, so far as I am aware, since it was first found by Dr. Robert Brown in about 1802 near about the same locality. From the present specimens I have been enabled to extend the description given in "Flora Australienses."

Order PALMÆ.

HYDRIASTELE, H. Wendl. and Drude.

H. Douglasiana, *Bail.* (n. sp.) A slender palm 20 to 30 ft. high. Leaves about 5 ft. long, the sheath, petiole, and rhachis covered with a whitish or brownish, harsh, scurfy substance; leaf-sheath rather short, petiole about 9 in.; segments about 20 on each side of the rhachis, very irregularly placed, sometimes 2 or 3 together forming distant sometimes confluent clusters; ribs usually 3, sharply prominent, folded and attached to the side of the rhachis, the apex of those in the middle of the leaf obliquely and deeply jagged, often forming on one side a tooth or point 2 in. long with a thread-like end, several of the terminal ones confluent forming a fan-shaped end to the leaf—these have truncate doubly toothed ends. Inflorescence below the leaves, a densely bunched flagelliform panicle; the common peduncle flat, about 1 in. long, the primary branches very short and flat, the rhachis of the spikes flattened, slender, and about 1 ft. long. The dried perianth under the fruit cup-shaped, about 2 lines diameter, the inner segments rotund and strongly striate. Fruit red, ovoid, $3\frac{1}{2}$ lines long, apiculate by the persistent base of the style, strongly ribbed; epicarp free from the thin endocarp, albumen not ruminate.

Hab.: Polo Creek, Somerset, Cape York Peninsula. This elegant palm is nearly allied to *H. Wendlandiana*, but does not fully agree with the published description of that species. Just before leaving Somerset, where I had spent a few days collecting, Mr. Jardine's son brought from a few miles distant specimens of what may prove an hitherto undescribed palm. The specimens consisted of a few leaves of the crown, and a loose inflorescence in early bud. A description, so far as the material to hand will allow, is here given in the hope that it may assist collectors in identifying the palm, and that better specimens may reach me from which a complete diagnosis may be published.

? Archontophœnix (sp.) Stem slender. Leaves 5 ft. long, without the petiole which is about 6 to 9 in.; leaflets often interrupted by spaces of a few inches without leaflets, about 30 on each side of rhachis, 18 to 22 in. long, folded at the base where they are attached to the flange-like side of the rhachis; the apex usually long, acuminate, or abruptly jagged and on one side elongating into a point which is at times toothed on the inner side and ending in a filiform point; end leaflets not confluent; leaf-sheaths not torn at the top, strongly striate, and ending on the opposite side of the stem in an erect point about $2\frac{1}{2}$ in. long; near the orifice and the base of the petioles are patches of flat, dark-purplish scales with undulate torn margins which under a lens somewhat resemble a lichen growth; all the rest of the leaf is almost glabrous. Inflorescence below the leaves, 16 or 17 in. long, common peduncle $1\frac{1}{2}$ in. long, rhachis and branches more or less angular puberulous, 8 in. of each branchlet bearing closely sessile flowers, solitary or 3 at each notch, 1 female with a male on either side. Perianth-segments 8, much imbricate and striate. Stamens numerous, probably about 20, in the young buds opened; stigmas 3, erect.

PTYCHOSPERMA, Linn.

P. elegans, *Blume*, Rumphia ii. 118 (*Seaforthia elegans*, R. Br. Prodr.) A slender-stemmed, quite glabrous palm, about 20 ft. high, bearing a crown of from 6 or 9 leaves, about 3 ft. long; the sheaths cylindric, not swelling out, 9 in. long, dark-green, striated, and ragged at the top; petiole 9 to 12 in., smooth; segments about 18 on each side of the rhachis, those of the middle of the leaf $1\frac{1}{2}$ in. broad in the centre, contracted at the base, very oblique and erose at the apex, except the terminal ones which have toothed broad truncate ends, and more or less confluent at the base; the rhachis sharply angled on the upper, obtusely angled or rounded on the under side. Inflorescence below the leaves; panicle about 20 in. long and broad; common peduncle $1\frac{1}{2}$ in., flattened, with 3 circular scars marking the place from where the spatha had fallen; rhachis and lateral branches flattened or angular. Flowers numerous, sessile, solitary or in twos or threes. The male or hermaphrodite ones with bractioles or sepals $\frac{3}{4}$-line diameter, imbricated, scarious ciliate; petals oblong,

2 lines long; stamens more than 20, filaments very short; anthers not exserted. Ovary 1-celled, white, oblong; style long as the ovary, together not exceeding the stamens, both glabrous; stigma capitate. The smaller flower-buds in the same notch with those above described may be female, but I did not examine them when fresh, and cannot be sure of this from the dried buds. My impression when examining the fresh flowers was that they were truly hermaphrodite; and if such should prove to be the case, then this plant must be placed in another genus. No ripe or immature fruit was obtainable. This is probably the plant mentioned by Dr. Robert Brown in Prodr. as *Seaforthia elegans*.

Hab.: Polo Creek, Somerset. June, 1897.

CARYOTA, Linn.

C. Rumphiana, var. Alberti. A tall, stout, glabrous, bipinnate palm. Leaves 16 to 18 ft. long, and 10 to 14 ft. broad. Leaf-segments very oblique, half fan-shaped, much plicate, 6 to 12 in. long, thick, coriaceous, irregularly and usually toothed, sometimes more or less pointed, the lower point often produced into a long obtuse point, sometimes shorter than the next fold. Peduncles very stout, bearing a vast number of long—all about of equal length, say 3 to 4 ft.—thong-like spikes of monœcious flowers, 2 males with a female between them; 3 outer segments of male perianth, imbricate, rotund, ciliate, 2 lines diameter; 3 inner segments valvate, 6 lines long, very hard; stamens numerous. Fruit globular, exceeding 1 in. diameter; white until quite ripe, when it becomes a deep purple.

Hab.: Somerset, Cape York Peninsula.

BORASSUS, Linn.

Diœcious, the spadices very large, simply branched; peduncle sheathed with open spathes; males with stout cylindric branches that are densely clothed with closely imbricating bracts, enclosing spikelets of flowers which hence appear as if sunk in cavities of the branch; female spadix sparingly branched, bearing few scattered solitary flowers. Male flowers small, mixed with scaly bracts, secund in two series in a small spikelet, and protruding one by one from the cavities of the branch of the spadix, as the rhachis of the spikelet elongates; perianth glumaceous; sepals 3, narrowly cuneate, tip inflexed truncate, imbricate; petals shorter than the sepals, obovate-spathulate, imbricate; stamens 6, anthers subsessile, large, oblong; pistillodes of 3 bristles. Female flowers larger, globose; perianth fleshy, greatly accrescent; sepals reniform, imbricate; petals smaller, convolute; staminodes 6 to 9; ovary globose, subtrigonous, entire or 3 or 4-partite, 3 or 4-celled; stigmas 3, sessile recurved; ovules basilar, erect. Fruit a large subglobose drupe with 1 to 3-obcordate fibrous pyrenes; pericarp thinly fleshy; stigmas terminal. Seeds oblong, top 3-lobed; testa adherent to the pyrene; albumen equable hollow; embryo subapical. A very tall palm; trunk stout, unarmed. Leaves terminal, fan-shaped, plicately multifid; petiole spinous, ligula short.—Hook. Fl. Brit. Ind. vi. 481.

B. flabellifer, *Linn.* "Palmyra Palm." Trunk 60 to 70 ft., very rarely branching, often swollen above the middle. Leaves 6 to 10 ft. diameter, palmately fan-shaped, rigidly coriaceous; segments 2 to 4 ft., linear, 2-fid-margins spinulose. Spadix male and female several feet long and very stout. Male flowers small; female 1 in. diam. Drupe broadly obovoid, brown, 8 in. diameter.—*Hook. l.c.*

Hab.: Cape York Peninsula. For the Australian habitat of this noble palm I am entirely dependent upon Mr. Frank L. Jardine, who has a male tree growing near his house at Somerset, which he tells me he brought when it was quite young from a locality upon the Peninsula forty miles from the coast. He says there was quite a clump of the palms, some having very thick stems, but the one he brought away with him was the only young plant he saw. At the present time the tree stands between 20 and 30 ft. high; and from the numerous forked spikes of old inflorescence scattered upon the ground around the tree, it must flower freely. The petioles of the leaves of this tree are broad, pale-coloured, and the marginal prickles scanty and small. The home of this grand palm is generally considered to be Tropical Africa, although it has been long cultivated in India, where its leaves are used for writing on and for basketwork, umbrellas, &c. The outer wood is hard, heavy, and durable, and weighs from 60 to 70 lb. per cubic foot. The pulp of the fruit is eaten, and the sap is fermented into toddy or made into sugar.

Order GRAMINEÆ.

PASPALUM, Linn.

P. Polo, *Bail.* (n. sp.) Stems few from each root, erect, somewhat flattened and slender, 1½ ft. high. The sheaths of the leaves on the lower part of the stems hirsute with stiff spreading hairs, the upper ones glabrous except for a few long hairs about the orifice; ligula scarious, truncate; blades 5 to 6 in. long, 3 lines broad, tapering to filiform points, glabrous, with nearly smooth edges. Spikes usually 2, when 3 two together at the top and the third inserted lower down, 2 in. long, slightly tomentose at the base. Spikelets about 1 line long, oval-orbicular, in 2 crowded rows, on very short pedicels. Outer glumes with a prominent midrib and a faintly marked nerve on each side near the margin. Fruiting glume hard glossy-brown with no visible nerves.

Hab.: Polo Creek, Somerset, Cape York Peninsula. This may probably prove a useful pasture grass.

P. platycaule, *Poir.* Stems creeping close to the ground and rooting at the nodes; internodes very short, erect stems from each node, flat, very leafy at the base, about 12 or 15 in. high; nodes woolly-hairy; leaf-sheaths very flat, glabrous, with ciliate margins; ligula rather short and jagged, lamina narrow-oblong, apex blunt, hairy about the base, margins undulate and ciliate; lower leaves 4 or 5 in. long and 7 to 8 lines broad, the upper one smaller. Peduncle exceeding the upper leaf by about 2 in. Spikes 2 or 3, hairy at the base; when 3 two at the end of the peduncle and the other ½-in. lower; about 2 in. long, rhachis slightly flexuose. Spikelets alternate forming a single row; outer 2 glumes marked with 2 green lines on each margin, softly hairy; others nearly white, nerveless, with a small tuft of hairs at the apex of the third.

Hab.: Cairns and along the Mulgrave road. This grass forms a very close flat turf of a deep bright green, and would be suitable for lawns and for an edging around flower-beds, besides which it is doubtless an excellent permanent pasture grass. It is indigenous in Tropical Africa and America, but whether indigenous in Queensland is at present uncertain.

ERIOCHLOA, H. B. & K.

E. decumbens, *Bail.* (n. sp.) A weak decumbent grass, the stems slender and branching, often geniculate, 1 to 2 ft. long, more or less pubescent about the nodes. Leaves 3 to 5 in. long, tapering from the base to fine thread-like points, pubescent at top of sheath; the ligula reduced to cilia. Spikes or panicle-branches about 5, secund, 1 in. long, pedicels with numerous long hairs especially under the spikelets. Spikelets silky, with the long fine awn 2 lines long; 2 outer glumes silky membranous, with rather long awns; 3rd glume shorter punctulate awned, somewhat coriaceous; stigmas dark-purple.

Hab.: On rocks, Hammond Island, Torres Strait. This grass differs from the other Australian species of the genus, principally in habit.

RUBBER-BEARING FIG OF RIGO, NEW GUINEA.

I have lately received a small packet from Mr. E. Cowley, of Kamerunga State Nursery, containing specimens of a *Ficus* which he informs me he had from Mr. Musgrave, of New Guinea, with the notice that they were off a tree from which rubber was being obtained in the Rigo District. The species approaches *F. retusa*, Linn., of which there are several varieties. It, however, differs, in my opinion, from all these in the leaf venation. So I have, at Mr. Cowley's suggestion, attached the name of the district in which the tree abounds as a specific name for the plant, and hope the brief description here given may assist rubber-gatherers to identify the tree.

FICUS, Linn.

F. Rigo, (n. sp.) Branchlets angular. Leaves alternate, oblong or obovate, 3 to 4 in. long, $1\frac{3}{4}$ to $2\frac{3}{4}$ in. broad, usually rounded at the end, sometimes slightly emarginate or showing a very short point, slightly cuneate at the base; lateral nerves prominent, patent except the 2 basal ones which, starting from the top of the petiole, run parallel with the margin and form the intermarginal one with which the other lateral nerves loop a short distance from the edge of the leaf; petiole rather slender, 6 or 7 lines long. Stipules narrow-acuminate, shorter than the petioles. Receptacles solitary on the specimens to hand, globular, 3 or 4 lines diameter; the 3 persistent-basal bracts large for size of fig, almost orbicular with thin torn margins. Florets closely resembling those of *F. retusa*, Linn., but the female ones seem to have rather longer styles.

Rice in Northern Queensland.

BY E. COWLEY,
Manager, Kamerunga State Nursery, Cairns.

IT would seem that it is not generally known *Oryza sativa* is a native of North Queensland as well as of many other tropical countries, but native rice is described by our Colonial Botanist, and has been seen by the writer in its wild form in this colony. The enormous flocks of wild geese indigenous to North Queensland, build their nests in places adjacent to the depressions wherein the rice grows, and choose the time when the grain will be ready for their offspring to feed upon—that is, before the young can take wing, but are able to paddle about in the rather shallow water in which the rice grows, as it were, for their especial benefit.

Rice, for commercial purposes, has also been grown by Chinese in North Queensland for many years past, and the output or harvest may be set down for this year at something like 200 tons. The Chinese do not appear to lay out regular fields for its cultivation, but seem to be content with the odd corners or depressions on their holdings or in banana-fields; it is therefore almost impossible to obtain a correct or even approximate estimate of the acreage of land devoted to rice culture. A gentleman, however, who lives in our neighbourhood, and who himself cultivates rice, informs me that an acre of good land will produce a ton of rice, and it would appear that this is considered a good crop in other rice-growing countries. The mode of planting differs in all countries. Here, on dry lands, it is planted broadcast and raked or hoed into the soil, weeds being kept down by hand until the rice has the mastery of the plot. All varieties of rice that have been introduced are planted in the same way. Whether the parent rice was swamp or hill grown it would be perhaps impossible to ascertain, but it grows and seeds admirably in either case. It would seem, however, according to numerous writers on the subject, that rice grown in irrigated fields yields a vastly larger crop than that grown on higher ground. Be this as it may, North Queensland grown rice commands a ready sale, and none, or very little, is grown in actual swamps. To insure a good crop of rice, even in North Queensland, the planting and cultivating right up to harvest time must be done in or during the wet season, when the ground and atmosphere alike are saturated with moisture. Like any other crop, it cannot resist total submergence for any great length of time, but it differs from many cereals, inasmuch as draining is not necessary. Simmons, when speaking of rice grown in Italy, says: "A clayey impervious soil, with a small proportion of sand near the surface, is found to be the best for rice." Perhaps this is most suitable when irrigation can be made available, but in almost any form of soil found on North Queensland river banks or backward to the waterholes generally found behind rivers, rice will do well, if planted at the proper time and favoured with a normal season. Rice is a six months' crop. With the Chinese, who are most unmerciful regarding their land, immediately after the rice is taken off and the rice stubs taken out, in goes a crop of corn —their land is never idle. They go on draining the bank until there is no more money; and then after about six years' crops of rice and maize, Nature cries: "Hold! enough!" I do not think our Government should allow this barefaced robbery of public wealth, but so long as the landlords do not take any steps why should the Government trouble?* I feel quite sure the Chinese consider us quite idiotic in these particulars, but I refrain from further remarks on the subject.

* This is a matter between landlord and tenant, with which the Government have no concern. The Chinese are quite awake to the value of manure.—Ed. *Q.A.J.*

It would appear that over 1,400 varieties of rice are in the Calcutta Museum, and though the names of very many of them are merely local synonyms a large number unquestionably correspond to intrinsic and seasonal distinction. The Indian varieties do not seem to have found much favour with North Queensland growers. The varieties most in favour are the Malay or Java sorts, known as White or Red Java, the latter being a bearded kind, said to be a persistent grain, requiring considerable effort to detach it from the panicles, and consequently may remain in the field until it is convenient for the owner to harvest it. This is a virtue that but few varieties possess, for the rice that is spilled from the ears, is often to be seen growing in green masses on the area from which the rice has been removed. It would seem also that this variety is well approved of by rice-millers. It is perhaps impossible to prove by what means or when this rice was obtained, or what is its Javanese synonym. P. L. Simmons, in *Tropical Agriculture* (Java), page 327, says:—"There are three principal varieties of rice recognised here: *Oryza glutinosa*, or Ketan; *Oryza sativa*, or paddy; and Sawa (*Oryza montana*), with a variety called Paddy Girek. This last sort falls from the stem immediately after being cut. Besides these principal kinds, there are more than 100 varieties, some of which are cultivated in upland grounds, but the greater part are grown in irrigated lands. The yield cannot well be fixed, for this depends on the kind of rice and the nature of the soil. A return of 80 to 100 for one is considered very good, although this is sometimes exceeded. The table rice is called 'Beras.' The glutinous rice is used for making pastry; the red rice is given to poultry and horses; the black rice is more remarkable for its colour than its quality."

Mr. Thomatis, of Caravonica Park, Cairns district, writes me that it takes about 40 lb. of paddy (rice in the husk) to plant an acre in his domain, so that it would seem the return is not so good on the Barron River as in Java. This is probably owing to the fact that irrigation has not been resorted to. The rapid subterranean drainage in most of our North Queensland lands precludes irrigation except over very small areas, even where the necessary elevation of water is available; perhaps in the future Lake Eacham may be tapped. The waters in that natural reservoir are several thousands of feet above the sea level, and would lend themselves to irrigation perhaps more readily than has hitherto been presumed. A sure supply of water for irrigation purposes would ensure an eternal spring and harvest in North Queensland. The cultivation of rice is well worthy the attention of the farmer. Rice certainly has not the glamour that surrounds the growth of coffee, sugar, and some other tropical spices, but there is possibly more money in it. Given fair land and favourable seasons, a comfortable living may be honestly looked for and expected without the aid of a superabundance of alien labour.

Coffee.

WILL COFFEE-GROWING PAY?

BY D. BUCHANAN,
Manager, State Nursery, Mackay.

I AM sometimes asked the question—"Will coffee pay?" By this, of course, is meant not whether coffee as an article of trade will pay, but whether it, as a field crop, will pay the cultivator.

I would advise all those who are in doubt about the matter to visit the State Nursery and see for themselves the crops on the trees here. Mr. Dansy, manager of the Mackay Coffee Company's estate, says he has not seen a better crop in Ceylon. Most people say that coffee must be grown scientifically, and for some, this word "science" seems to have a fearful significance, but at the Nursery they may see a crop grown on non-scientific principles. At the outset I began planting on scientific lines. Starting at the surface of the ground, it was considered necessary to maintain a clear height of stem of 6 or 8 inches, without any branches. This single stem was to be continued, and no suckers were to be allowed to grow.

Under this system I soon found that all the plants would require staking. This was all very well for a few months, but when the branches began to grow, I saw that the stakes were not strong enough, and they had therefore to be replaced; then when the usual wet season, with its gales of wind, swept over the plants, neither stakes nor stems could resist their violence, and the greater part of the plants were laid flat. I very soon came to the conclusion that the local conditions and the scientific working were not in accord with each other, and that some different plan must be adopted.

No more pruning and no more destruction of suckers taking place, the single stem soon thickened, the branches began to rest on the ground, and formed the necessary support for the trees. The result is that the trees are in fine condition, and the crop of berries is as was stated by Mr. Dansy.

Some books recommend manuring; and the scientific method recommended consists of digging a hole or two round the roots, in which the manure is placed. Now, the consequence of this is that the roots cut off in digging receive no benefit, and those at a distance from the holes would have to travel if they wanted to share in the good things supplied in the shape of manure. My non-scientific method was to spread the manure over the surface of the ground within a radius of some 3 feet from the stem, and then lightly prick it in with a digging fork. The result of this was that, as soon as the rain fell, the plants showed dark-green foliage in abundance.

It is just possible that when the coffee "expert" visits this Nursery he may order these bushes to be dug up, and I would therefore advise anyone who has been lamenting his ignorance of coffee-growing to come here, and, after what he has seen, he will perhaps have an easier mind.

The other day I had a visit from an intending coffee-grower, who no doubt was impressed with fears for his success after reading a mass of books on the subject. After looking at several of the bushes, he expressed the opinion that growing coffee by book was not the way to succeed. There is, however, a danger of going to extremes on either side, but it is plain that hard-and-fast rules must give way to circumstances.

From what I have written it might be supposed that I ignore science in agriculture or horticulture, but such is not the case. Science has done much in the past and will do much in the future for agriculture. All I want to impress upon readers of the *Journal* is: Do not let science be the bugbear to frighten you out of the field. If you want to grow coffee and you possess average common sense, put that common sense to work. If you have not got a farm, then look out for one—a good piece of land well sheltered from the wind Having selected your farm, "look over the hedge," and watch the man who is succeeding in the industry. Take his advice and follow it, as far as your own particular environments will allow. You are then not likely to fail.

If a crop of coffee berries can be raised, such as may be seen here, where the soil is by no means to be considered congenial to the growth of the plant, and where the land is exposed to the fury of the gales that sweep over the place, it shows that there is not so much mystery about the matter as is supposed.

For land such as that at this Nursery, I believe manuring to be an absolute necessity, as I notice that some trees bear better than others. Some trees are absolutely barren, although I believe I have none here. In Ceylon these trees are called "males," but such nomenclature does not speak well for the botanical knowledge of those who so designate them. The coffee-tree is not diœcious; it is an hermaphrodite. Perhaps the expression merely means a barren tree; but, whatever they are, it might be as well to dig them out and plant others in their place. To avoid the risk of raising non-bearing trees as far as possible, seeds should be selected, when it can be done, from the bushes bearing the largest crop of berries. The trees here having now strong stems and being well rooted, the branches, as soon as the present crop is gathered, will be thinned out, thus complying with scientific instructions as to letting in light and air.

There are many people who, even if they have the necessary capital and knowledge, are physically unfit for the laborious work of cane-growing, but they would be perfectly capable of growing coffee. While the price remains at its present figure, coffee-growing will pay better than cane-growing at the present price of sugar; and where there is a family of children the pickers are ready at hand.

I feel sure that a good future is in store for the coffee-growing industry; and it is just those farmers who have 30, 50, or 100 acres of cane who can go in for coffee successfully, as they have money coming in to tide them over the three years during which they have to wait for a crop.

A Tropical Industry.

INDIA-RUBBER (CAOUTCHOUC).

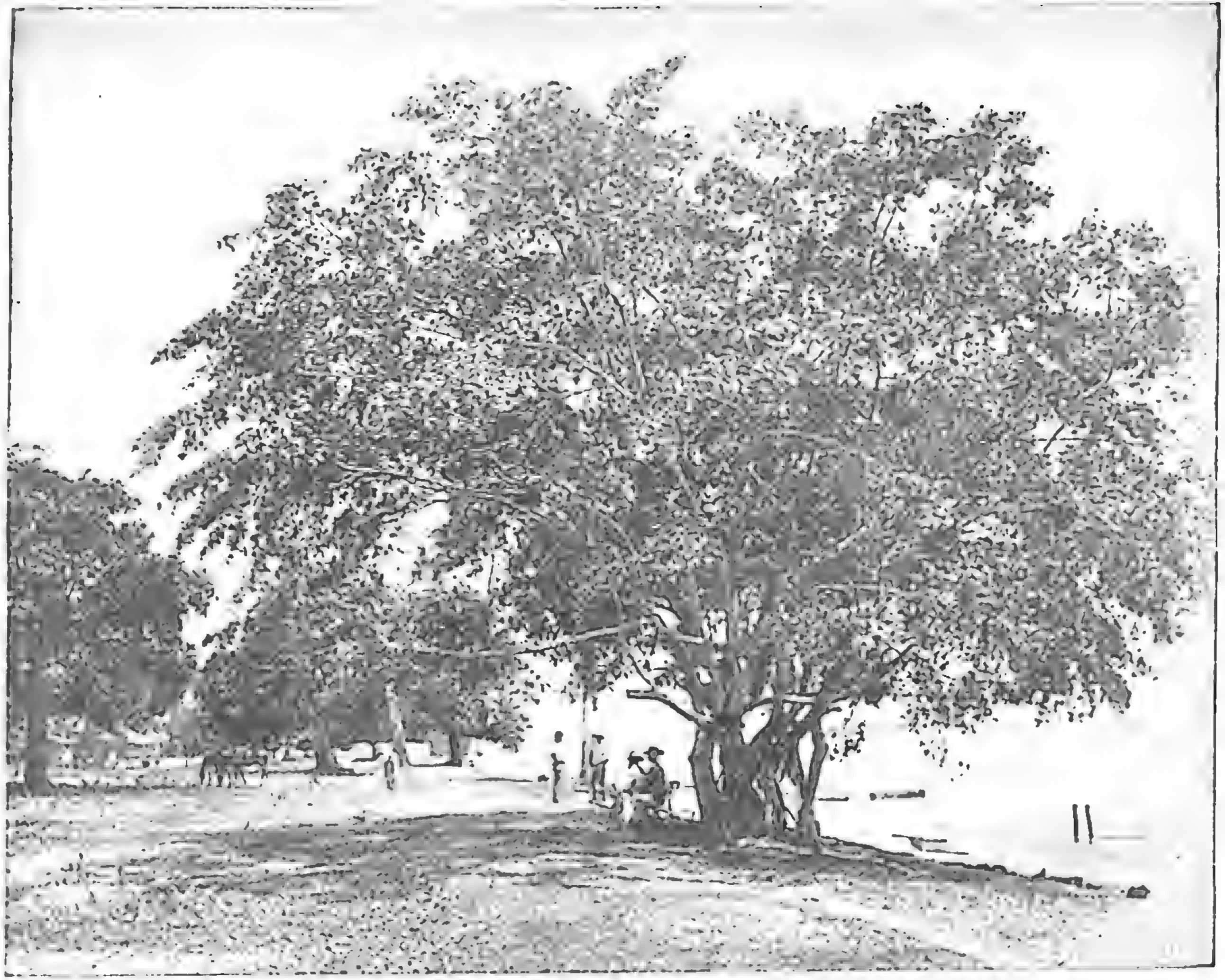
Part III.

By E. COWLEY,

Manager, Kamerunga Nursery, Cairns.

Since my last article, mainly on *Manihot Glaziovii* or Ceara rubber, was written, the Under Secretary for Agriculture, Brisbane, has sent an intelligent observer to the Esmeralda Plantation, Mourilyan Harbour, to inquire into the state of that India-rubber growing property. The report of his mission is before me, and what was surmised in my last article has been verified by it. A few only of the original trees planted have survived, but beneath and round about there are plenty of seedlings, from which cuttings might be derived. These seedling plants are evidently from the self-sown fruits of the original trees. The tree is *Manihot Glaziovii*. The exact age of the plants cannot, with the evidence at present in hand, be determined, but probably the older or parent trees are fifteen or sixteen years from time of planting. This is, of course, mere conjecture. The caoutchouc, of which a small cake was obtained, seemed to be somewhat sticky at first; but this has worn away, and it seems now to have all the characteristics of dark-coloured India-rubber, but contains soil-like impurities and moisture, which would probably amount to a considerable percentage of its weight. It is satisfactory to know that India-rubber has been obtained, even in such a very small quantity, from *Manihot Glaziovii* grown in Queensland. From my own personal observation, I am led to believe that plants derived from seed direct are best. Cuttings grow, or rather strike readily enough; but I am very doubtful if they would grow into such symmetrical trees or mature so rapidly as seedling plants, and I also think they would be better not transplanted. This, however, will have to be determined later on. Mr. Medley Wood, of Natal, has stated that his trees, which are from cuttings, bear abundance of fruit, so that multiplication of the plant may rapidly be advanced by planting cuttings to bear seed for plantation purposes alone. I am led to believe, from what I have read and from personal observation, that the Ceara rubber would probably be the best form of rubber-producing tree to plant in Queensland for economic purposes, but, as many different plants are being yearly recorded as caoutchouc yielders, it certainly would be premature to say anything positive in this regard. We know the tree thrives particularly well in North Queensland, and that it yields caoutchouc, but whether the latter is secreted in sufficient quantity to repay the cost of growth and collection remains to be proved. It should be remembered that, notwithstanding the tree thrives in Queensland, it has been introduced from South America, and may not yield caoutchouc so well with us as it seems to do there.

I think it hardly proper to consider here the very many varieties of rubber-producing plants which have and have not been described botanically by botanists, but confine myself to plants which have been grown in Queensland for some years past, having, as was the case with *Ficus elastica*, been



FICUS THYNNEANA, Bail.

Growing on the beach at Cairns, locally known as "Banyan."

introduced for its beauty and as an ornamental plant. In Europe it is cultivated by many for the same reason. In Great Britain it is, of course, grown only in green or hot houses. G. Nicholson, A.L.S., in his "Dictionary of Gardening" says:—"*Ficus elastica* (elastic), India-rubber plant; leaf coriaceous, 6 inches to 18 inches long and 3 inches to 6 inches broad; upper surface dark-bright shining green, yellowish-green below. East Indies, 1815. This splendid plant is very largely grown both for indoor decoration and for sub-tropical gardening."

In Johnson's Gardener's Dictionary we are told: "*Ficus*, fig-tree. The fig-tree has nearly the same name in all the European languages, and is supposed to be derived from the Hebrew name '*fag*.' Besides the cultivated figs, there are a vast number of other species belonging to *Ficus*, all natives of the tropics, where they arrest the attention of the traveller either by their grateful shade, their enormous growth, or by their manner of sending down roots from their branches to support and extend their distorted arms, as in the Banyan-tree. Propagation by layers and cuttings. In either case dry the cut ends before inserting them in sandy soil, but not removing more of the leaves than those of the joint cut through."

Some cuttings of *Ficus elastica*, obtained in British New Guinea by the writer, were successfully introduced and have become established at Kamerunga. Some of the plants have grown well, and a quantity of branches are available as cuttings. It is not known if *Ficus elastica* is indigenous to British New Guinea; presumably not, as these cuttings were obtained from a garden near Port Moresby, and they had evidently been planted there. No record of the plants could at the time be obtained. The extreme beauty of the leaves of this tree in its early stages is very marked, and visitors do not fail to admire the peculiar soft covering of the early leaves. This covering is a peculiar protection for the unfolding leaf; it has a charming colour of cream to pink and red, and disengages itself as the leaf opens, and falls to the ground. The leaves of *Ficus elastica* are, as Mr. Nicholson says, coriaceous, so much so that they can be used for a surface on which to write a text or name: the leaves are of very considerable vitality—names written on their surface remain readable for two years, while the leaf itself remains green. The branches send down aerial roots, and so *resemble* the Banyan somewhat. Altogether, it is a most interesting tree. On account of its rapid growth and stability, it would, if planted from 20 to 30 feet apart, form an almost faultless breakwind for coffee estates; and it is possible, even probable, that in future years a considerable income might be derived from its caoutchouc-yielding ability, and render a coffee farm still more valuable. It would seem that some slight shelter from the sun would be required when the cuttings of *F. elastica* are put into the ground, but once they have a fair start the plant becomes very hardy, and is hardly likely to fail. It seems to flourish as far south, at least, as Rockhampton. Von Mueller says of *F. elastica* (Roxburgh): "Upper India to the Chinese boundary, known as far as 28 degrees 30 minutes north latitude, extending to Burmah and the Malayan Islands. A large tree yielding its milk-sap copiously for the kind of caoutchouc known as Assam rubber." Roxburgh ascertained eighty years ago that India-rubber could be dissolved in Cajaput oil (very similar to Eucalyptus oil), and that the sap yielded about one-third of its weight of caoutchouc. This tree has grown in Assam to 112 feet, with 100 aerial roots, in thirty-two years (Markham). In moist, warm climes, according to observations in Assam by Mr. Gustave Mann, branches lopped off and planted will soon establish themselves. Single branches attain a length of 50 feet; the root crown will attain a diameter of 200 feet exceptionally (Hæckel). The import of caoutchouc into the United Kingdom in 1884 amounted to 198,000 cwt., representing a value of £2,266,000, of which *Ficus elastica* must have furnished a considerable proportion; in 1888 the value of the unworked rubber then was estimated at £3,500,000 (J. G. Baker). Markham and Collins pronounce the caoutchouc of *Ficus elastica* not quite so valuable as that of the *Heveas* and *Castilloas* of South America. Heat and

atmospheric moisture greatly promote the growth of *F. elastica.* Like most other fig-trees it is easily raised from seed. A tree of *Ficus elastica* is tapped in Assam when twenty-five years old. After fifty years the yield is about 40 lb. of caoutchouc every third year, and lasts till the tree is 100 years old. The collected sap is poured into boiling water and stirred until it gets firm; or the sap is poured into large bins partly filled with water. The fluid caoutchouc mass after a while floats on the surface, when it is taken out and boiled in iron pans after the addition of two parts water, the whole being stirred continuously. After coagulation, the caoutchouc is taken out and pressed, and, if necessary, boiled again; then dried and finally washed with lime water. The sap from cuts in the branches is allowed to dry on the trees (J. Collins). Dr. S. Kurz states that *Ficus laccifera* (Roxburgh) from Sihet is also a caoutchouc-tree, and that both this and *F. elastica* yield most in a ferruginous clay soil on a rocky substratum; further, that both can bear dryness, but like shade in youth. Several other species of tropical figs, American as well as Asiatic, are known to produce fair caoutchouc, but it is questionable whether any of them would prosper in extra-tropical latitudes. Nevertheless, for the conservatories of botanic gardens all such plants should be secured with a view of promoting public instruction. To give some idea of the vastly-increasing extent to which rubber is now required, it may be stated that at Wetzell's factories in Münden and Hildershein alone during 1884 were produced 100,000 lb. of surgical articles; 100,000 lb. valves, buffers, and washers; 150,000 lb. hose and belting; 200,000 lb. insertion sheets and truck packings; 250,000 dozen of fancy coloured balls, irrespective of other rubber articles. There is no question that the existing market for caoutchouc is a good and rising one; the question is, Will it continue good? Immediate returns from any India-rubber producing industry, except that of tapping indigenous trees, is out of the question. A period of at least six years must elapse, after planting, before any return could be expected, even if *Manihot Glaziovii* were the plant selected to operate upon. With *Ficus elastica*, Von Mueller tells us, twenty-five years must elapse before the tree is fit to be tapped, even in Assam, and it is improbable that this variety would mature sooner, or even so soon in Queensland as in that country; but, be that as it may, *F. elastica* is a tree that recommends itself not only to private persons possessed of suitable lands and who may be desirous of leaving their children a valuable heritage, or perhaps enjoy it themselves in later years, but to the nation (if I may call Queensland a nation). There should be no party feeling in our Legislature in regard to the desirableness of planting some of the highly favoured portions of Northern Queensland, belonging to the Crown, with groves of *Ficus elastica.* Many of the islands on our coast offer favourable localities for this enterprise, as most of the land thereon is not available to the ordinary selector. Our legislators could do much more than lay the foundation of future natural wealth, by planting considerable areas of this desirable tree. I have been led to consider that private enterprise in the direction of planting rubber-producing trees would be a failure economically, except under such conditions that the trees would assist some other agricultural proceeding, as break-winds for coffee estates or the like. Certainly a number of rubber-producing trees should be planted in all school grounds, where they will grow, not only as an ornament, but as a direct educational object. Among others indigenous to Queensland, it is probable that the tree known as "*Alstonia,*" *Ficus macrophylla*, and *Ficus rubicinosa* would yield rubber; this may be said of *Wrightia milgar*, &c, but it would appear that no special investigation has been hitherto made into the capabilities of any of our own caoutchouc-yielding trees.

Mr. Musgrave, the secretary for the Government of British New Guinea, has very kindly forwarded to me some specimens of rubber obtained in the district of Rigo, some thirty miles to the eastward of Port Moresby. The rubber seems to be of excellent quality; it is firm, of a light-brown colour with a shade of pink, and seems to have been collected with considerable care. The

specimens are in small cakes, and have a very presentable appearance, each cake weighing about 4 oz., a very handy size. In his letter on the subject, Mr. Musgrave says :—

"The greater part of the rubber now being exported from this possession is collected in the eastern division, and I will endeavour to obtain any statistics I can for you. The industry, as you are aware, is still in a nascent state; we are not unmindful here, by any means, of the great demand for this product in the world's markets, but with our small population, and the almost total absence of capital, the advancement of this, as well as of other highly important resources we possess, is distressingly slow.

"I am forwarding to you, per parcel post, seeds of one of the best rubber plants known, from the Rigo district, or about forty miles east of Port Moresby. It is called there the 'Maki,' but I am not sure whether its scientific title has been positively fixed. In fair soil, I am informed, it grows in the Rigo district with exceptional rapidity," &c.

The plant specimens Mr. Musgrave so kindly forwarded have been sent to our Colonial Botanist for determination. From a layman's point of view, it seemed to be a *Ficus;* but Mr. Bailey will decide, and should his decision be forthcoming before writing next month's concluding article it will be included.

Sugar at Bundaberg.

We reproduce this month some illustrations of field operations on Messrs. Gibson Bros.' sugar plantation at Bingera, on the Burnett River, Bundaberg. These were taken by Mr. F. C. Wills, artist to the Department of Agriculture and give an excellent idea of the method of working a plantation.

Bingera, which is situated fourteen miles from Bundaberg, is one of the finest estates in the district, and is managed by the proprietors on the most rigid principles of efficiency and economy. In the present article we shall confine ourselves to the outdoor operations, leaving description of the sugar-house, the machinery, the milling, and sugar manufacture for our next issue. Bingera consists really of three estates worked from a common centre—viz., Watawa, The Cedars, and Bingera proper. These are all connected with each other by a railway eleven miles long, on which four engines and a large number of cane trucks (single and double), such as are used on the Government main lines, are busily employed in conveying cane to the mill, a vast establishment in which is a plant with every modern appliance for disposing of 600 tons of cane per day of twenty-four hours. This means 3,000 tons of cane every week, equal to the produce of about 120 acres, or over 300 tons of first and second sugars. Owing to the dry weather during the growing season, the present crop is not turning out so heavy as was expected; and for the same reason the cost of cutting and loading is greater than would have been the case had the rains come at the proper time, and consequently enabling the cane to make a longer growth, resulting in a heavier crop. This season the cost of cutting amounts to 1s. 6d. per ton, loading into the drays from 6d. to 7d. per ton, and thence into the railway wagons 3d. per ton.

To one who has never seen a large sugar estate in full working, the sight in the fields is most interesting. Gangs of kanakas are busily engaged in the various operations of cutting, topping, and trimming the cane ready for loading. Others load it into the tramway trucks which are laid down in sections branching from the main permanent tramways.

To take, however, our illustrations in due order, we will begin with the preparation of the ground and planting the cane. The steam and other ploughs and harrows having reduced the soil to a proper state of fine tilth, straight furrows are drawn by a plough of the double mouldboard type, which makes one furrow 8 inches deep into which the plants are nicely laid. The sets used formerly to be planted at regular distances of 6 x 3 or 6 x 4 feet, but now the plan is that of continuous planting—*i.e.*, the plants close to each other. By adopting this method, misses are avoided, and uniformity in the subsequent crop is secured. As the cane plant is laid in the furrow, the labourer covers it with from 3 to 4 inches of fine mould.

Our illustration shows the field hands carrying on this work in rear of the ploughs. Like all other crops, the after cultivation consists in keeping the young plants free from weeds until they cover the ground and stifle the weeds to a great extent.

The crop having arrived at maturity, which it does in about ten or eleven months, the field will present the appearance shown in the second illustration. Here we have a field of cane eleven months old. This field has carried a continuous crop of cane for ten years, when it was decided to plough out the

stools, the last crop yielding only 10 tons of cane per acre, proving that such frequent ratooning is very unprofitable. The ground was worked up by the steam ploughs 12 inches deep; it was then allowed to rest for six months; and while planting was going on at the end of that time, about 10 cwt. of manure per acre was sown in the furrows with the cane plants. The manure used was kainit, lime, superphosphate, and filter press cake. Experiments with the latter have proved it to possess very great manurial value, as will appear in the next illustration.

Deep ploughing and manure have given a verdict in favour of the outlay on this field, as 25 tons per acre will be the average return from 100 acres of eleven months' growth plant cane, and this in the driest season ever experienced in the district. It should, however, be mentioned that this land is also drained with 2-inch, 3-inch, and 4-inch agricultural pipes. The drains are from 2 feet 6 inches to 3 feet 6 inches deep, and about one chain apart. This depth and distance appear to act very well on the volcanic land at Bingera. During the growth of the cane referred to, there has been no rain that reached the pipes, but no doubt the latter supplied a cool current of air, which refreshed the plant life, as over the 900 acres of land now drained as described, the cane always held green, even if it did not grow as one could wish; but then there were no rains worth mentioning.

The third illustration shows on the same field one of the many stools of cane in the block fully 8 feet high. This remarkable growth, during the dry season mentioned above, is due to the fact that in many parts of the field, whilst it was being planted, heaps of filter press cake were dumped down as a supply for the planters. Wherever this happened there would be naturally a larger amount of manure than where it was merely sown in the furrows; and hence a larger amount of plant food being supplied to the stool, it outgrew the rest. The obvious conclusion is—as much manure of the right kind, consistent with the value of the increase.

Had there been the usual rainfall, and this block of cane had been left until the end of September, instead of being cut in the early part of August, 35 tons would have been the average weight per acre.

In the fourth illustration, we see the canes loaded on the trucks standing on the portable tramline. These lines are laid down on the canefield about 100 feet apart—that is, there are always two lines working, and a third being laid down. They all branch from the main permanent line. One is for the returning empty trucks, the other for the loaded ones. When the latter has done its duty by carrying off all the cane in its immediate vicinity, it is taken up and conveyed to a point beyond the third line, where it is again laid down in a marvellously short space of time. Thus no stoppage or collision can take place. The trucks are wooden frames on four iron wheels, and carry 30 cwt. each. There are 500 of them on Bingera. On the fields, horse-power is used for hauling them; but on the main roads, on which the gauge is 2 feet, small locomotives are employed. The kanakas on the load have just filled the trucks, and a team of four horses will haul a 20-ton train off the field, whilst the locomotives will haul a load of 70 tons on the main line.

In addition to several miles of permanent and portable tramlines, there is on the estate a private railway line connecting the factory and Bingera Railway Station, on the Bundaberg-Mount Perry line. On this private line is a railway bridge (shown in the fifth illustration) 324 feet long, 12 feet wide, and 12 feet high, spanning a watercourse, and built to Government specifications. The gauge of the line is 3 feet 6 inches, which is that of the Queensland Government lines. The locomotive shown belongs to the firm, and works the branch service. Sugar can thus be sent, in a wagon loaded at Bingera, over the whole of the Queensland system in the South and West, and soon will be able to reach Gladstone.

Watawa, an integral portion of Bingera, is thirty miles from Bundaberg and twenty from Bingera, on the Mount Perry line. On this estate there are thirty-four lessees, twenty-eight of whom are growing cane under a ten years' agreement, and whose cane is purchased by the mill proprietors at a price varying according to the density of the juice. Three miles of tramway run through the farms, none of the farmers having more than half a mile to draw the cane. In the illustration, the farmers are represented loading cane into Government wagons by means of derricks, of which there are some sixteen at various sidings conveniently situated on the branch line. By these derricks, the cane, which has been loaded on to two chains in the bottom of the dray, is lifted bodily out and swung on to the railway truck in a few minutes, thus obviating the handling of the cane and waste of time.

One of the firm's locomotives is in attendance on this line, taking in empty and running out full wagons from the sidings. From this estate 200 tons of cane are daily being removed to Bingera, which works in conjunction with it. Last season 12,000 tons of cane were taken in this manner from the Cedars to the Bingera mill.

KANAKAS PLANTING CANE (Bingera).

KANAKAS CUTTING CANE (Bingera).

STOOL OF RAPPOE CANE—11 MONTHS (Bingera).

CARRYING CANE ON PORTABLE TRAMWAY (Bingera).

RAILWAY BRIDGE ON BINGERA PLANTATION, BUNDABERG.

LOADING CANE (Wattawa Plantation).

The Canna.

By GEORGE WATKINS.

The Canna in Botany belongs to the class of Monocotyledones or Endogens; sub-class, Petaloideæ. By many authorities it was considered as a genera of the Natural Order Scitamineæ; the Ginger family. This is now generally divided, and formed into three orders, viz.:—The Scitamineæ, Zingiberaceæ, or Gingers; the Marantaceæ, Cannaceæ, or Arrowroots; and the Musaceæ, or Bananas.

The Marantaceæ or Cannaceæ are herbaceous plants with tuberous rhizomes and simple sheathing leaves, having a strong midrib, with numerous parallel veins thence to the margin. There is strong resemblance in foliage, flower, &c., to the Gingers, but an entire absence of aromatic qualities.

The inflorescence takes the form of a terminal-spike or raceme, with either erect or pendulous flowers. The showy bright part of the flower consists not only of the calyx and corolla, but also of the altered stamens and style.

The perianth is superior, with the calyx three-lobed, short, and insignificant in appearance. The corolla is tubular elongated, three-parted, and likewise rather insignificant. The chief beauty lies in the stamens. These are typically, six in number, in two whorls. They are petaloid in character—that is, they take on the appearance of petals of the corolla, rather than that of stamens. They unite at the base, the claws forming a tube. The flower may therefore in some respects be considered as a naturally double one. One only of the inner whorl of stamens develops an anther, which has a petaloid filament. It has two lobes, but only one is fertile, dehiscing longitudinally.

The style is also petaloid, and forms a thick flat ribbon-like structure, bearing a line of stigmatic tissue on the naked apex.

The fruit is usually a three-celled capsule, but frequently only one cell contains seeds, which vary in number. These seeds are round, black, and very hard, especially in the outer skin. Hence the popular name of Indian Shot, as they are reported to have been frequently used for shot in the West Indies. They have been used as a substitute for coffee.

The plants of the order are all natives of the tropics; the greater number of America. A few species are found in Africa and the East Indies.

The order Cannaceæ is divided into nine genera. There are generally supposed to be about 160 species.

The name *Canna* is said to be derived from an old Carib name of the plant; *Maranta* from Bartolommeo Maranta, a physician of Venosa, who died in 1559. It was bestowed in his honour by the botanist Plumier.

The rhizomes, or tuberous stems of the plants of the order, contain much starch, which, properly prepared, forms the arrowroot of commerce.

Maranta aurundinaceæ, and probably one or two other species, yield that which is known as West Indian or Bermuda arrowroot. The name arrowroot is usually supposed to be derived from the fact that the Indians used the bruised rhizomes as an antidotal application to the wounds from poisoned arrows, but some authorities contend that the word comes from "aru-aru," the name which the Aruac Indians of South America give to the farina obtained from the manioc.

Tous-les-mois, another form of arrowroot, is produced in St. Kitts and other West India Islands from the underground stems of *Canna edulis*, and possibly other species. The name Tous-les-mois is said to be derived from Touloula, which is a Carib designation for *Canna*. It is also said to be given in consequence of the plant flowering the whole year round.

This is the variety of arrowroot produced in Queensland. It is in all respects as valuable and nutritious as the Maranta arrowroot, only a little darker. Under the microscope it is very distinctive in character. The granules are very large, exceeding in size those of all other known starches. Maranta arrowroot only is recognised under the Food and Drugs Act of Great Britain, and last year a dealer at Ashford, in Kent, was prosecuted for having sold Queensland arrowroot instead. The case was dismissed on the ground that there was no intention to defraud, but the fact was pretty well established that Queensland arrowroot could only be sold in England under the distinctive name of Queensland arrowroot.

Efforts have been made to induce the cultivation of the Maranta plant instead of the *Canna edulis* for the production of arrowroot in Queensland. It is contended that as a food product the Tous-les-mois is equal to or more valuable than the others, and the yield of farina is very much greater per acre. Again, the Maranta roots much deeper than the *Canna edulis*, consequently requires deeper and more expensive cultivation. For the same reason it is much more expensive to harvest.

The species of *Canna* resemble each other very closely in all particulars, and much confusion has arisen from the same name having been given by different authorities to different species; while the same species has been furnished with a number of varying names.

There are four well-marked sections or sub-genera distinguished by the length of the corolla-tube and the characters furnished by the staminodia or petal-like stamens. These are called—

1. *Eucanna* or true Cannas.
2. *Distemon.*
3. *Eurystylus.*
4. *Achiridia.*

In the *Eucanna* the corolla lobes and the staminodia unite in a short tube at the base, two or three of the upper staminodia being developed.

There are nineteen species—1, *indica*; 2, *orientalis*; 3, *flavescens*; 4, *coccinea*; 5, *latifolia*; 6, *heliconiæfolia*; 7, *pedunculata*; 8, *Lamberti*; 9, *edulis*; 10, *Finlelmanni*; 11, *glauca*; 12, *compacta*; 13, *luteæ*; 14, *variabilis*; 15, *lanuginosa*; 16, *Warscewiczii*; 17, *polyclada*; 18, *speciosa*; 19, *discolor*. Of these *indica*, *glauca*, and *Warscewiczii* have been most used in the production of the garden varieties of to-day, the last having a great influence in the brown and red leaved varieties.

In the sub-genus *Distemon* the corolla-tube is short and the upper staminodia suppressed.

There is one species, *C. paniculata*, but it is not worth cultivating except as a botanical curiosity.

In the sub-genus *Eurystylus* the corolla-tube is long, and the upper staminodia three. There is one species, *C. flaccida*, a native of the swamps of the Southern United States. It has been much used in hybridising.

In the sub-genus *Achiridia* the tube of the corolla and the staminodia is very long, and the flowers very large and pendulous. There are two species—*iridiflora* and *liliiflora*. The first is a native of the Andes, and was introduced by Lambert into Europe in 1816. It has been a very large factor in the production of the garden varieties, and is the most gorgeous plant in the genus. It grows to a height of 10 feet, and has a pinicle composed of several corymbs of drooping rose, crimson flowers 5 or 6 inches long.

All these species readily hybridise with each other.

From about 1830 to 1860 attention was given to *Cannas* chiefly as foliage plants, and cultivation and hybridisation was carried on with this purpose in view. Plants for decorative purposes were grown up to 10 or 12 feet high with broad leaves, ranging from tender green through all shades to red and purple. Only hybrids of the true *Cannas* or sub-genus *Eucanna* were produced.

About 1863, *iridiflora* was crossed with *Warscewiczii*, and the result was the fine variety first called *Iridiflora hybrida*, but afterwards *Ehemanni*. This pointed out the possible value of *Cannas* as flowering plants, and attention was directed to the raising of varieties, of dwarfer growth, with brighter-coloured flowers broader in the petal (or staminodia, correctly speaking) thicker in texture, on finer and more massive spikes.

The greatest advances have been made in France, where the climate was better adapted to the plant outdoors than in England.

The grower pre-eminent of others is M. Crozy, of Lyons, and his name must ever be associated with the production of the garden *Cannas* of to-day. So thoroughly is he identified with them that he is said to be known in his own neighbourhood as Papa Canna, a name which has been also bestowed on one of his latest varieties.

Mr. George Paul, in a paper read before the Horticultural Club, 14th November, 1893, gives the following:—"In a very brief note (for my request for information gave M. Crozy barely time to catch the post) he says—'My *debût* in the race of *Cannas* dates from about twenty years ago. I began with *Warscewiczii* and *Nepaulensis grandiflora*, a tall variety of which I have reduced its height little by little. My first gain was *C. Benneti*, a variety much appreciated at the time; since that time, constantly progressing, I succeeded in obtaining the splendid variety Madame Crozy, which, by the year I had it ready to put into commerce, had given me 1,500 seedlings. These, flowering, have given me all shades of colour, and since then I have improved in the rose and carmines, even attaining nearly to whites.'"

Other French growers of note, who have raised fine flowers, are Vilmorin, of Paris, and Lemoine, of Nancy.

In England, Paul and Sons, of Cheshunt, and Cannel, of Swanley, have given some attention to the genus.

In Germany, Pfitzer, of Stuttgart, has sent out several splendid varieties, notably Konigen Charlotte.

In Italy, Danman and Sprenger have lately come to the front with notable advances.

In Mr. Paul's paper before-mentioned he writes—

"I have attempted some hybridising, but, though satisfied with the dwarfer habit and fine flower in the yellows, I do not think that I or other raisers have yet rivalled Crozy's gains. In a quantity of seedlings, the proportion of good seedlings is small, the majority reverting to older types. I think seven or eight were all I selected from four or five hundred, which flowered when planted out this season."

The climate in Queensland is very suitable to the raising of new varieties. The plants seed freely here, and will flower frequently in their first season. My neighbour, Mr. J. E. White, one of our amateur members, has several seedlings of merit. Messrs. Pink and Cowan have several fine ones, and Mr. W. B. Bailey, of Pimpama, tells me that he has two or three that he considers good.

I have tried my hand, but so far have none of real improvement on parent varieties. With me there seems to be a great reversion to yellow grounds, generally lightly spotted.

Some varieties seed most freely, while others do so sparingly. Madame Crozy this year has seeded in abundance, while last year I had no seeds from it till late in the season.

The outer coat of the seed is, as before stated, exceedingly hard, and without help the germ is seldom able to break through. It requires heat and moisture, and the best way is to soak the seed in very hot water for about twelve hours before planting; let the seed bed be exposed as much as possible to the sun, and water frequently. Even then only a few germinate, and that most irregularly. Some authorities recommend filing through the outer coat, others the use of boiling water.

It is surprising how few people grow *Cannas*, and how very few, our nurserymen inform me, will buy them. Scarcely any plant will give a better return, and the kinder you are to them the more responsive they are in gratitude. No flower suits so well the lazy gardener, or those wanting a display without trouble. Neglect reduces the quantity and quality of bloom, but *Cannas* will not be denied existence in spite of it.

A loose rich soil is the most suitable; and given this, with abundant moisture, of which they are greedy, and plenty of manure, of which they are almost more greedy, the results will open the eyes of those who despise *Cannas* as being only Indian Shot.

For outdoor decoration they are most valuable, but as cut flowers they do not stand well. In water the *Gladiolus* will open to the last bloom on the spike, but the *Canna* stands still, and the individual flower, already open, soon begins to droop.

The plants are most effective in clumps or groups, or massed in a back border. They prove most useful to fill up out-of-the-way spots and awkward corners, and will bloom away in Queensland, either cared for or neglected, for nine or ten months in the year. They like full exposure to the sun.

The stools at the end of the season should be broken up, and rhizomes with bold strong buds replanted in a fresh spot, or in the same place, after being well manured. If left alone, the stools crowd themselves out to starvation.

In flower, all shades of colour are obtainable, from pale-lemon to dark-crimson; and in foliage, from blue-green to bronze and purple. Many of the red, orange, and crimson varieties are edged with yellow and gold; and the yellows spotted and blotched with all shades from brown to dark-crimson. No real white so far exists, though some people speak of the *Hedychium conorarium*, or Indian garland flower, as the White Canna. It is somewhat of a family connection, and efforts have been to hybridise between them, but so far without and most probably will be without success.

I rather wonder that nothing has been achieved in this direction with the species *Iridiflora liliiflora*. It has three white upper staminodia. No doubt it has been experimented with, and some day a white garden variety will be developed (*vide* Crozy's note above). *Liliiflora* was introduced by Von Warscewicz from Veragua about 1855, is similar to *iridiflora*, but the flowers are white and flagrant.

SELECTIONS.

It is difficult, or impossible, to draw up a list to comprise those only of greatest merit. New varieties are being constantly brought out, of which we can have no real knowledge. Many of good repute in European and other catalogues are not included in those of colonial nurserymen. Several of these furnish long lists, but they seem to be deficient of many of the well-known best varieties. I can only furnish a selection from my own knowledge, and it can therefore be only comparatively reliable.

No collection of any pretension can be without some of the new so-called orchid flowering varieties, raised by Danman and Sprenger. These are the result of crossing the species *flaccida* with Madame Crozy and other garden varieties. Italia and Austria are now obtainable in Brisbane. They are both splendid varieties, much broader in petal than any of the old gladiolus-flowered kinds.

The texture of the flower, from the *flaccida* side, is thin and soft, and they therefore burn and wither somewhat when exposed to our hot summer sun. The foliage is green and massive.

Austria is clear canary in colour, plentifully sprinkled with small red spots. It is strong in root growth, and increases very fast; hence it is quoted, no doubt, in many lists at a lower price than its fellow.

Italia is golden yellow, with bright scarlet blotch and throat; in fact, the blotch covers the greater part of the flower. The spike seems more massive than that of Austria, and it frequently throws out small side branch spikes after the main spike is exhausted.

Madame Crozy is still, I think, unrivalled among the gold-edged varieties. Mr. White claims that his "Winifred" is even more striking; the scarlet of the Crozy being superseded by a rich, glowing crimson.

Franz Bucher is a beautiful golden-edged variety, with a ground of a salmon shade of orange, difficult to describe. The petal is broad, and the margin wavy. The plant is very dwarf.

Konigen Charlotte is a dwarf-growing variety, and one of the best and most striking. There is much more of golden edge than in Madame Crozy.

Professor David (Crozy) is a good variety, narrower in petal than those before mentioned, but an abundant bloomer; yellow, blotched with chocolate or dark-brown.

Among the spotted varieties, Comte de Bouchard holds pride of place in my experience. It has very broad flowers, heavily spotted with dark-red. Florence Vaughan has a great reputation, and is often said to be the best, but I have not seen it. I ordered it last year, but the plant supplied me, at a good price, proved to be none other than Admiral Courbet, one of the oldest and most floriferous of all. Need not say there is a black mark across the name of the seller with me. I am inclined to think I was sold, as well as the plant. Admiral Courbet was also supplied to me by another man for I. D. Cabos, said to be one of the best orange varieties. Another black mark against that seller. It seems hardly likely that mistakes can be made in these plants. They certainly should not be, and there must be great negligence, otherwise ignorance or even worse, when it is done.

Other really good spotted varieties are Tigre, L. E. Bally, Progression, Senateur Montefiore, all of Crozy's raising. I have a very good seedling from Pink and Cowan of this class.

In green foliage and crimson flowers, the best I know is Alphonse Rouvier (Crozy). It is rather a tall variety, with splendid broad petals of rich dark-crimson. Kaiser Wilhelm II. (Pfitzer) is another good variety which increases fast. It is very effective and floriferous. Compte Horace de Choiseul is one of the finest. The habit is dwarf, and the spikes very dense; but it is not such a robust grower as K. Wilhelm. Antoine Crozy, Souvenir de Jeannæ Charreton, and Miss Sarah Hill are other good varieties.

Among the reds, with dark foliage, Victor Hugo is a striking variety. The flowers, if somewhat small, are of a most intense crimson. It is tall in growth.

Gloire de Lyon is the best I have in this class, strong in growth, and very floriferous, throwing a strong spike of orange scarlet flowers.

The Garden is a good orange with green foliage.

Guttermane has massive green leaves, and is tall in growth. The flowers are very distinct, rosy-buff in colour. It belongs more particularly to the *iridifloria* group.

Paul Marquant is a peculiar shade of orange-salmon, with a noticeable silvery sheen overlying it; growth rather dwarf.

Noutoni, rich crimson; Ehemanni, scarlet; Bruanti, rose; Nadir, red—belong to the *iridiflora* group with pendulous flowers, and all are good varieties.

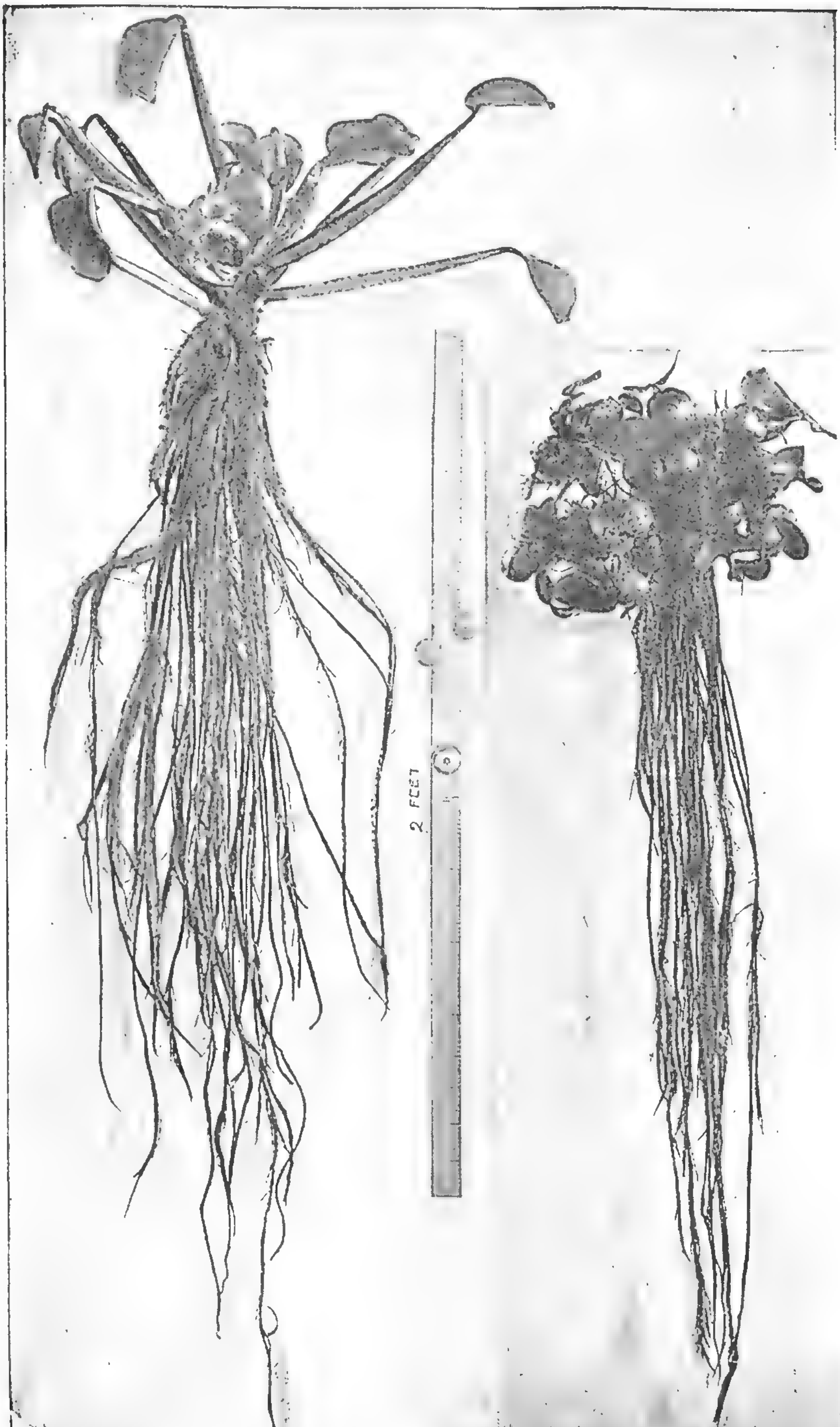
In drawing up this paper I am much indebted to our good friend, the Colonial Botanist, Mr. F. M. Bailey, for advice and the free range of his valuable library; and to Mr. J. H. Maiden, director of the Botanic Gardens, Sydney, from whom I received the loan of an extremely useful volume. The paper itself is based on the work of Professor J. G. Baker, keeper of the Herbarium at Kew, who is the greatest authority on the subject. He has analysed, reduced to order, and recast the whole of the work of his predecessors, of whom the most notable have been—Roscoe, Bouché, father and son; Regel, Lambertye, and Miller.

The Water Hyacinth.

BY WILLIAM SOUTTER,
Brisbane Acclimatisation Gardens.

I WOULD sound a note of warning against the introduction of this abominable, although pretty, water-weed. You sounded a note of warning in one of the daily papers some months ago. In our Queensland rivers we are not likely to find the Hyacinth so destructive as where rivers are looked upon as the highways of commerce, especially in rafting. A friend of mine, writing from a station on the Rio Grande del Norte, America, states that, at some seasons of the year, it is next to impossible to negotiate some parts of the sluggish reaches of that river with timber rafts; while to *ascend* these reaches in a boat is absolutely impossible. When floods supervene, the masses of *Pontederia* break away and swing out of the current, and form high masses in the smooth water near the banks, where it is no common occurrence to find the plant piled up several feet above the level of the water; and when it dries sufficiently, the lumbermen set fire to it, and it burns furiously down to near water level. As an evidence of how rapidly the plant spreads, ample illustration is obtainable in a pond in the Botanic Gardens, where, from a few small pieces planted about a couple of years ago, the plant has spread over nearly half the pond in a solid mass, to the utter exclusion of every other water plant. The *Pontederia* is all right as a pretty aquatic plant for a small aquarium, but if it once gets into any of our freshwater rivers—with room to spread—it will be good-bye to water-scenery; occasional floods may help to keep it under, but, depend upon it, it will give us a deal of trouble.

ANOTHER correspondent writes as follows on this subject:—The Venezuela Water Hyacinth is regarded in America, like the English sparrow, as a very troublesome intruder. It has been in the country only a few years, and its field has been limited; yet it has succeeded in practically closing perhaps 200 navigable miles of Florida's great river, the St. John's. The plant increases from the seed and from runners. A field of it completely covers the water, and no steamboat can penetrate it beyond a short distance. The Federal Government has been asked for an appropriation with which to fight the Venezuelan Hyacinth.



EICHHORNEA CRASSIPES—WATER HYACINTH.

Chemistry.

By J. C. BRUNNICH,
Agricultural Chemist.

PRACTICAL DETERMINATION OF THE STARCH-CONTENT OF POTATOES.

When potatoes are judged, generally only the most striking points, such as time of growth, crop, shape and appearance of the tubers, skin, flesh, &c., are taken into consideration, and the most important point, the starch-content of the potatoes, on which their value as a food mostly depends, is completely overlooked.

The composition of the potatoes depends on a good many factors—not only on the variety, but also on weather during growth, cultivation, soil, &c. The average composition of a good class of potatoes is—

	Per cent.
Water	75·0
Nitrogenous substances	2·0
Fat	·3
Woody fibre	·5
Ash, salts, &c....	2·0
Starch	20·2
	100·0

These figures show that the chief part of the dry substances is starch, and this starch-content may vary from 10 per cent. to 26 per cent. Climate, soil, manuring, mode of cultivation, variety will all influence this content of starch; and every farmer should try to find a variety of potatoes which suits his soils and other circumstances best.

The operation itself to determine the starch value is so easy, quick, and costless that every grower should know how to use it. As a rule the following varieties contain about 18 to 20 per cent. of starch :—Snowflake, Extra Early, Vermont, Early Rose, Brownell's Beauty; 20 to 22 per cent. is found in Bressel's Prolific and Late Rose; 22 to 24 per cent. in Peerless.

The determination of the starch-content is based on the fact that the dry substances of which, as already said, starch forms the chief part are heavier than water; and consequently potatoes, which are rich in these dry substances, will have a higher specific gravity than poorer, more watery potatoes.

$$\text{The specific gravity of a body...} = \frac{\text{Weight of body.}}{\text{Weight of equal volume of water.}}$$

Numerous practical determinations have shown that the specific gravities given in the following table correspond to certain starch-contents :—

Specific Gravity.	Starch. Per Cent.	Specific Gravity.	Starch. Per Cent.
1·060	9·5	1·096	17·8
1·062	10·0	1·098	18·2
1·064	10·4	1·100	18·7
1·066	10·9	1·102	19·2
1·068	11·3	1·104	19·7
1·070	11·8	1·106	20·1
1·072	12·2	1·108	20·6
1·074	12·7	1·110	21·1
1·076	13·1	1·112	21·6
1·078	13·6	1·114	22·1
1·080	14·0	1·116	22·5
1·082	14·5	1·118	23·0
1·084	15·0	1·120	23·5
1·086	15·4	1·122	24·0
1·088	15·9	1·124	24·5
1·090	16·4	1·126	25·0
1·092	16·8	1·128	25·5
1·094	17·3	1·130	26·0

The specific gravity of a given sample of potatoes can be found by using the following methods :—

1. A vessel (preferably glass) of about two gallons capacity is filled with a strong brine solution containing about 1 part of salt by weight to 3 parts of water.

A sample of potatoes, say 12 to 16 of the tubers, after having been washed and dried, are thrown into this salt solution; and will be found to be floating. Pure rain water is now slowly added, under stirring, to reduce the strength of the salt solution until only one-half of the tubers remain floating. When this point is reached, the specific gravities of the solution and of the potatoes are the same. The specific gravity of the salt solution is now simply determined with the help of a hydrometer or salinometer. [A similar method is used to determine rapidly the sugar-contents of sugar beets.]

2. A few of the potatoes are weighed in a bag made of very fine netted silk, and then weighed again suspended and immersed in water. This second weighing will be less than the first weight found, the difference in the two weights being the weight of a volume of water equal to the volume of the potatoes; and from these two weights the specific gravity is easily calculated from the formula given above.

An accurate balance is required for this method—in fact, special balances have been constructed for the purpose; and therefore this method is perhaps not within the reach of a practical farmer.

3. The last method is not only quick, very accurate, but requires only very little apparatus. This method was first recommended and perfected by Professor Stohmann.

The apparatus required consists of a cylindrical glass vessel holding about one gallon, the upper part of which is ground fairly horizontal; two metal strips (M and *m* in Figs. I. and II.), having each in the middle a pointer of brass and a pipette (P) and a burette (B) necessary to measure accurate volumes of water.

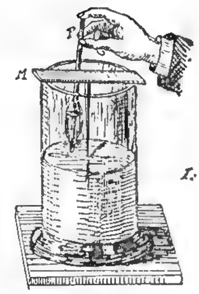


Fig. I.

To start the operation the vessel is filled with water until the surface just touches the point of the longer pointer, which is placed on the top of the vessel. When this point is nearly reached, water is only slowly added with the help of the pipette. The accurate point is easily and sharply determined as soon as the reflected picture of the needle-point and the point itself touch each other. Now the strip M is replaced by strip *m* with the shorter pointer, and water is now slowly added from a burette, which allows the operator to ascertain easily the volume of water added, until the surface again touches the point of the needle. This operation is only done once for all determinations, and gives the volume V of water necessary to fill the glass vessel between the end of pointers on M and *m*.

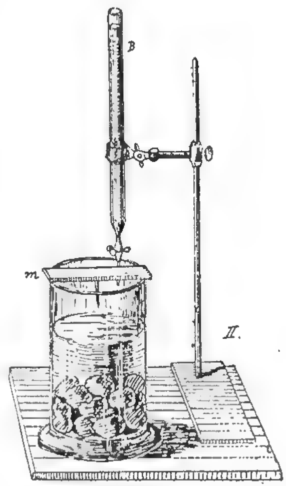


Fig. II.

To carry out the determination of starch in a sample of potatoes, the vessel is again filled as in Fig. I. to pointer M; and then 10 to 12 tubers, which were previously well washed and dried with a soft cloth and also weighed (total weight G) as carefully as possible, are cautiously put into the water contained in the vessel. Spirting of the water has to be avoided. The water, of course, will rise in the vessel, and now, by putting the strip *m* on, it will be found that a much smaller volume of water V (Fig. II.), which is carefully added with the burette B, will be necessary to raise the water to the level of the point of the needle on the strip *m*. The specific gravity is easily calculated by the formula—

$$\text{Specific gravity} = \frac{G}{V - v}$$

By looking up the specific gravity in the table given above, the actual content of starch in the sample of potatoes is found.

Method of Destroying Rabbits with the Microbes of Chicken Cholera.

BY C. J. POUND,

Government Bacteriologist, Brisbane.

FROM practical experience the following has been found to be the most satisfactory method of destroying rabbits by means of microbes of chicken-cholera:—

Trap from 20 to 50 live rabbits, and keep them in a large cage constructed so that they cannot possibly escape.

Inoculate 2 of the caged rabbits in the following manner:—

Secure the rabbits and make a small incision with a pocket-knife through the skin of the back, then take one of the small tubes of infected broth, and, after having broken off both ends, insert one end through the incision and gently pass it along for about 1 inch immediately under the skin, and then carefully blow out the contents.

It is desirable to point out that there is no danger whatever in carrying out this operation, even should the contents of the tube be drawn by mistake into the mouth, as the microbes of chicken cholera are absolutely harmless to human beings.

Having inoculated the two rabbits, they are returned to their cage. In from 14 to 24 hours either one or both will be found dead from chicken cholera. As the virulent microbes grow very freely in the dead body of the inoculated animal, it is advisable to remove the rabbits immediately after death and keep them from 4 to 6 hours in a cool and shady place. Afterwards inoculate 2 more rabbits by making an incision, as in the first instance, and introduce under the skin by means of a pocket-knife a little blood taken from the edge of the liver of one of the dead rabbits.

The inoculated rabbits are then returned to their cage.

The next step is to utilise the microbes, which have been cultivated in the dead inoculated animals, for destroying rabbits on the sand hills in open country.

This is carried out as follows:—Open both the dead rabbits and remove the heart, lungs, liver, kidneys, and any blood which may have escaped during the operation from the larger bloodvessels, into a bucket, and thoroughly mash them up with about a quart of water; then add 1 gallon more water and about half-a-bushel of pollard to make a fairly stiff paste; when thoroughly mixed, it is distributed in the form of pellets, about the size of marbles, in and around the rabbit burrows.

The next day, the second pair of inoculated rabbits will be dead, when, after inoculating a third pair, the process of removing the internal organs, mixing them with pollard and distributing the same over fresh sand hills, is again repeated, and so on, until the entire stock of caged rabbits is used up, when a fresh start with another lot of trapped rabbits may be commenced in another locality.

Tubes of infected broth containing virulent chicken-cholera germs may be obtained only upon written application to the Government Bacteriologist, Stock Institute, Brisbane.

It is hoped that all persons making use of this method of rabbit destruction will report to the Government Bacteriologist whether the results they obtained were satisfactory or otherwise.

On sand hills where rabbits are extremely numerous, and where water is scarce, the following method, which has proved successful, may be adopted, viz.:—Secure several shallow vessels, such as kerosene tins cut down to about 3 or 4 inches in depth, jam tins, &c.; half fill them with water; then take the livers of rabbits recently dead of chicken cholera, and mash them up by squeezing through the fingers, and well mix with the water. The tins of infected water are then placed under a shady bush in the immediate vicinity of a rabbit warren, in order to protect them from the sun's rays. It is advisable to sink the tins an inch or two in the ground to prevent them being easily knocked over.

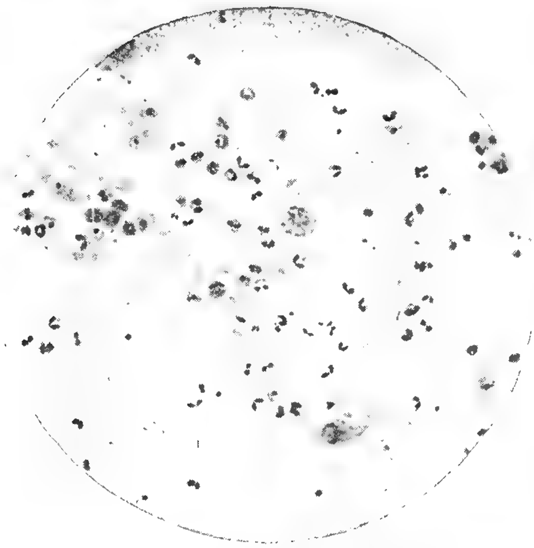
Tick Fever.

BY C. J. POUND.

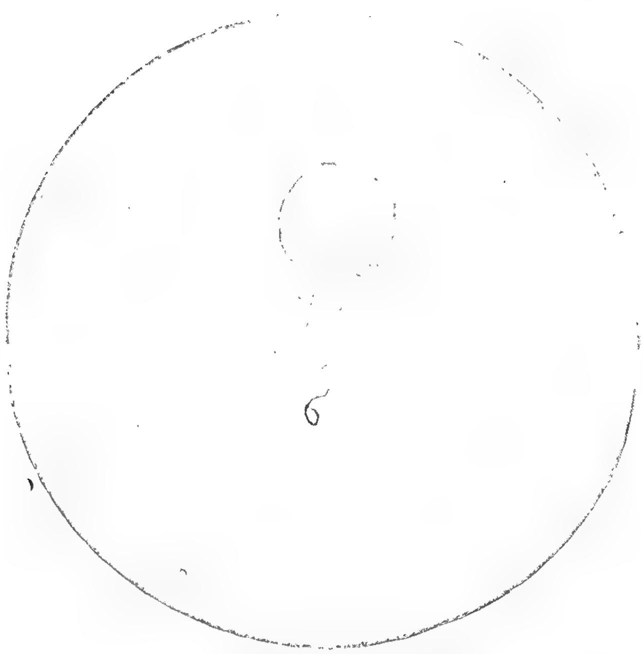
IN the accompanying photo-micrograph of blood from a bullock suffering from acute tick fever, showing intra and extra cellular organisms, some of the latter, it will be noticed, are quite round, while others are pear-shaped, the latter being quite characteristic. In the acute stage of the disease, these organisms are found more frequently in pairs inside the red blood corpuscles.

In the early stages of the disease, and when an animal has recovered, they are found as a rule existing singly outside the blood-cells, moving free in the serum. In this stage they are actively motile, and invariably possess a delicate filamentous tail known as a flagellum, by means of which the organism propels itself through the serum amongst the blood-cells. A further use of the flagellum is to enable the organism to penetrate the red blood-cell. As no method has been discovered by means of which the flagellum can be stained, and from the fact that they cannot be photographed in the living condition, only the accompanying drawing can be given, but it may be mentioned that this is a faithful drawing from a specimen of blood examined under the most perfect form of apochromatic, one-twelfth oil immersion lens, illuminated by means of a specially devised paraffin lamp. The specific name given to this organism is *Pyrosoma Bigenimum.*

The magnification is exactly 500 diameters. The photo-micrograph was taken by Dr. John Thomson, of Wickham terrace, Brisbane, from a specimen stained with Kuhne's methylene blue, and prepared by Mr. C. J. Pound. It may be worthy of mention that this is the first photo-micrograph ever taken of this particular micro-parasite.



MICRO-ORGANISMS OF TICK FEVER IN BLOOD OF BULLOCK.
MAGNIFIED 500 DIAMETERS.



EXTRA-CORPUSCULAR MICRO-ORGANISM WITH FLAGELLA ATTACHED TO RED BLOOD CORPUSCLE. MAGNIFIED 2,000 DIAMETERS.

General Notes.

INDIA-RUBBER.

Commander Leeper, R.N., in referring to the account of the India-rubber industry given by Mr. E. Cowley, manager of the Kamerunga Experiment Station at Cairns, states that the conditions therein mentioned as conducive to the growth of the trees furnishing "Para" rubber are to be found in the Solomon Islands. Mr. Cowley says the conditions are: "Rich alluvial clay slopes by the side of rivers, where there is a certain amount of drainage and the temperature reaches from 89 to 94 degrees Fahr. at noon, and is never cooler than 73 degrees Fahr. at night, while rain is seldom absent for ten days together." A large portion of the group is now under British protection; hence it might be worth while considering whether certain of the islands might be exploited in this direction. From a meteorological journal kept by Captain Leeper in those islands from April to November during the years 1882, 1883, and 1884, we quote the following:—

"Highest shade temperature, 96 degrees Fahr.; lowest, 74 degrees Fahr.; daily mean, between 81 and 84 degrees; average rainfall, about ½-inch per diem."

It is true there are no large rivers, but numerous small streams exist; and in the valleys through which they flow, possibly sufficient alluvial land may be discovered suitable for the growth of rubber-trees. It must be borne in mind that the interior of the large islands has by no means been properly explored, and it is quite within the bounds of possibility that these trees or some similar variety are indigenous. The remaining months of the year—viz., December to March—appear, from observations taken by local traders to be much the same as regards temperature, with rather more rain, this being the time of the north-west monsoon, and consequently the wet season.

SUB-DRAINAGE.

Referring to Mr. A. Watt's paper on sub-drainage, read at the late Farmers' Conference at Gatton College, Mr. H. Logan, of Happy Valley, writes—

"Mr. Watt, in describing methods of draining, said that stones can be used with good effect, 'if the large ones are put in the bottom and the small ones on top.'

"Mr. Watt is, I presume, a Scotchman, and that used to be the way in his time, but we have found out by experience that the reverse is the better way. We put the small ones in the bottom and the larger ones on top. It must surely be quite plain that if you put a large stone in the bottom of a 3-inch (bottom measurement) drain it must block the water. Stones for drains are broken up like road metal, and passed into a wire sieve to sift out all the dirt before placing them in the drains. That was the method adopted when I left home in 1876. Perhaps they have fallen back on the old plan.

"In the north of Ireland they have a plan as good as any, and cheap. That is when you are taking out the last 'spitten,' or what is called 'bottoming,' you leave about an inch or so on each side for what is called a 'cheek'; then get a good stiff sod, put it on, grass side down, and tramp it well. This gives a drain that will last for a long time if the subsoil is stiff clay."

FARM WAGES.

Farm wages in the northern counties of England, according to the *Agricultural Gazette* (England) of June 14, do not appear to have ruled high at the northern hiring fairs lately held. "The following rates may be taken

to represent wages for the summer half-year to Martinmas next, including meat and lodging in the farmhouses of the employers:—Headmen who take the management of the farm in the absence of the master, £20; best men, £15 to £18; second-class, £12 to £14; boys and youths, £4 to £10; good dairymaids, £11 to £12; second-class women, £8 to £10; girls and young women, £4 to £7."

How do these rates compare with the wages for farm servants ruling in Queensland? And yet the article we are quoting goes on to say: "As these money wages represent more than is necessary for clothing, the thrifty farm servant of the present day is enabled to put by after a few years—when matrimony is contemplated, and more especially if the intended wife has been equally saving—sufficient to stock a small farm, which here ranges from 30 to 200 acres, and thus it comes that the bulk of our farmers have sprung from the farm-servant class."

Here should be a chance for our emigration lecturers. If, as doubtless is the case, many of the northern farm-servants are saving money to set up for themselves by-and-by, it should not be difficult to find some who could be induced to employ a portion of their savings in paying their passages to a colony which offers such great inducements to farmers as does Queensland. Climate, food, virgin soil, fuel, house-room, clothing—all these are better and cheaper than in the old country. The farmer here is not bound down by restrictions as to cropping, draining, fencing, rotation of crops, &c., as he is there; whilst as to wages, taking them all round, they are at least double those obtainable in England. If Queensland were as near to Great Britain as Canada and the United States, shiploads of able-bodied men and women, paying their own fares, would be yearly landed at our various seaports, and very soon the Western lands would be covered with agricultural and grazing farms, whence rich freights of produce would be distributed in various parts of the world.

BROAD *V.* NARROW WAGON TIRES.

MR. J. T. BELL, M.L.A., on the day of the official opening of the Queensland Agricultural College, when examining the carts and wagons of the institution, remarked on the narrowness of the tires, and stated that they would have an injurious effect on the roads.

The Cape of Good Hope *Agricultural Journal* has the following on the subject, taken from a Bulletin issued by the Ontario Department of Agriculture:—

"It is not only necessary to make good roads; it is also necessary that they should remain good. For this reason, all European countries, advanced in road-making, have laws regulating the width of tires used on wagons, carts, and vehicles for heavy draught.

"In France, the width of tires ranges from 3 to 10 inches, usually from 4 to 6. Every market wagon and tonnage wagon is a roller; the forward axle is about 14 inches shorter than the rear axle, so that the hind wheels run in a line about an inch outside the level rolled by the fore wheel.

"In Germany, wagons used for drawing earth, brick, stone, and similarly heavy loads must have a width of tire of at least 4 inches.

"In Austria, all wagons built to carry a load of more than $2\frac{1}{4}$ tons must have tires at least $4\frac{1}{3}$ inches in width. In Lower Austria, a rim of $4\frac{1}{2}$ inches is required for wagons drawn by two horses.

"In the State of Michigan, persons using the wide tires receive a rebate of one-fourth of their road tax.

"Experience goes to show that broad tires are very much to be preferred for drawing loads through fields and on farm roads, as they sink less deeply into the soft earth and employ less draught to move them. On rough, rutted roads the advantage is slightly in favour of the narrow tire in point of draught, but when wide tires are used by all there will be no rutted roads. One farmer, using tires as narrow as 4 inches, says that in the spring time he has only to

drive up and down his lane a few times to change it into a smooth level driveway. Those who will observe the occasional wide track made on our own country roads will understand this result.

"Towns and cities are no less affected by narrow tires than are rural districts, and it is little short of absurd that property-owners should go to the expense of laying expensive pavements, while those most benefited continue to destroy them with narrow tires. The city of Ottawa has recently adopted a wide-tire by-law, and this example, it is hoped, will soon be followed by others. To understand the evil effect of narrow tires, one has only to observe an empty, springless wagon jolting along the highway, or a loaded wagon ploughing its way through the crust of a gravel road in fall or spring. At all times narrow tires on wagons of heavy draught are the greatest destroyers of roadways. To get the most benefit from the statute labour and other road expenditure, to lessen the cost of road making and maintenance, narrow tires must be discarded by those engaged in heavy teaming on our roads.

"Broad tires, on the contrary, are in a way a benefit rather than a detriment to roads. The broad surfaces perform the work of rollers in keeping a smooth and compact roadway free from ruts. Wide tires, more than any other means that can be adopted, distribute wear over the surface of the road. Narrow tires do the work of a pick on a roadway, while broad tires do the work of a pounder. The one tears up, the other consolidates."

FARM POULTRY.

It came to us as a bit of a surprise when we learned last week that the Government of New Zealand were taking steps to establish a poultry-breeding station in the vicinity of Auckland. But when we come to consider the figures published by the Kansas (U.S.A.) State Board of Agriculture in connection with this branch of rural industry, the surprise is that we, in Queensland, have not pushed poultry farming much beyond exhibiting a few fancy fowls at our various shows. Mr. Smirrell, an erstwhile breeder and exhibitor of poultry, speaking on the subject of poultry-breeding, said: "There is nothing in it. It does not pay." Now, we commend to Mr. Smirrell and to all others interested in poultry the following statements from a *bonâ fide* official source:—

"In the year ending 1st March, 1896, the value of Kansas poultry and eggs sold was $3,608,815,* or 19 per cent. more than the entire value of the rye, barley, buckwheat, castor beans, cotton, hemp, tobacco, broom corn, milo maize, Jerusalem corn, garden and horticultural products marketed, wine, honey, sheep, and wool of the same year. No field crops, with the exception of wheat, corn, and hay, equalled in value the surplus sold from the Kansas hens, ducks, turkeys, and geese in the year named.

"It was a sum sufficient to pay all the State and city taxes of the preceding year, and leave on hand the comfortable nest-egg of $175,000 (£36,458 6s. 8d). Its value was nearly twice (or 95 per cent.) greater than the same year's output of lead and zinc from our mines, conceded to be of great richness, and within 23 per cent. of the value of all the coal mined during the preceding year. It was 23 per cent. greater than the total paid for teachers' wages and school supervision; more than three times as much as the total combined amounts paid for school sites, buildings, furniture, rent, repairs, district library and school apparatus, fuel, incidentals, and all other school purposes except salaries. In fact, the poultry came within about 14 cent. of paying the entire cost of the public schools.

"The average value of poultry and eggs sold annually in the State, as returned to assessors, in the five years ending with 1896, was $3,333,562 (£694,492 1s. 8d.), or a value greater by nearly 10 per cent. than that of the potato crops for the same year; 55 per cent. greater than the sorghum crops; 71 per cent. greater than the millet and Hungarian, and 168 per cent. greater than the value of Kaffir corn.

* Reckoning the American dollar at 4s. 2d. sterling, this is equivalent to £751,836 9s. 2d.—Ed. *Q.A.J.*

"Prices of poultry and eggs in 1896 were not high, but the year's surplus sold from Kansas farms amounted to within 2 per cent. of the total value of all milch cows owned in the great cattle-raising regions of Colorado, New Mexico, Arizona, and Utah; more than the value of all cattle owned in Oklahoma, with the swine of Colorado, Montana, Nevada, and Wyoming added; for about the same as the value of all the sheep in the six New England States and those of New York and South Carolina added; nearly as much as all the sheep in Texas were worth; or as much as the value of all the corn of New England with that of North Dakotah, Montana, and Wyoming thrown in for good measure."

POULTRY ON THE DAIRY FARM.

WHILE dairy farming is a specialty, it is so because it stands at the top of all agricultural pursuits. The old maxim that "All roads lead to Rome" finds a variety of applications in these days, but nowhere more truly than when applied to dairying. All other agricultural operations are tributary to it, and it, in turn, is dependent on them. Everything fits in with it. The dairy farmer must plough, plant, and harvest; be a scientific breeder and rearer of cattle for his purpose; have full information about foods and feeding; and, more than any other farmer, can indulge in side lines. Indeed, these side lines are really indispensable for the economical disposal of his by-products. Among these side lines there is nothing which will give better returns on dairy farms than poultry, and nothing, perhaps, in the proper management of which there is greater room for improvement.

Whether considered from its universal nature, or from the profit of its products, poultry-keeping is surely a most interesting and attractive subject. In the combination of the dairy and poultry business we have a most happy union, and it has often been a matter of wonder to many why our dairy farmers do not place more emphasis on poultry as a source of income. The poultry business requires no large amount of capital, and labour on the farm that would otherwise be idle can very largely be utilised in attending to it. The same customers who take the dairy produce would only be too glad to get the poultry supplies, so that no extra expense in marketing would be necessary. Poultry can be kept very largely upon what would otherwise be wastes of dairy business. Hens fed on butter milk or skim milk will yield a better return than when such milk is used in any other way. Much of the mixed food for dairy cows is admirably suited for feeding poultry; little additional building is necessary; no extra help required; the capital invested in poultry can be withdrawn in a few days by sale of poultry; the waste products of the dairy are converted into profit; and the combination of dairy and poultry business seems the most natural, the most attractive, and perhaps the most profitable adjunct to dairying that can be thought of.—*Agricultural Gazette.*

THE PERA BORE.

THE value of a water supply obtained by means of bores is very well illustrated in the following article in the *Maitland Daily Mercury*, and with the magnificent supplies obtained from our Queensland artesian wells there is no reason why, instead of allowing the water to be available only for travelling stock, they should not form a centre round which comfortable, thriving homesteads may spring up, benefiting not only the immediate neighbourhood but the whole colony:—

"On Saturday the Minister of Mines (Hon. Sydney Smith) with several members of Parliament paid a visit of inspection to the Pera bore, which is situated a little more than eight miles from Bourke, in a westerly direction.

"The Pera bore is one of a series of thirty-two Government bores which have been established in the Bourke district in an area measuring 4,000 square miles, while there are within the same area about eighty private bores. The

Pera bore is situated on a travelling stock route, and was established originally for the purpose of watering travelling stock, but finding that the bore yielded a supply of water greatly in excess of that required for travelling stock, Mr. Sydney Smith determined upon the establishment of an experimental farm upon the site. The soil was such as seemed eminently adapted for such a purpose. Not only has an experimental farm, consisting of 60 acres, been established, but in addition there are twenty blocks of 20 acres each set apart for settlement. Only a little more than two years has elapsed since tapping the water; but it is said that the settlement has already passed the experimental stage and is proving highly profitable. Some at least of the settlers of the town of Bourke used to rely to a considerable extent upon vegetables grown locally by the Chinese; but it is said that vegetables grown at Pera are coming into active competition with those grown at Bourke by Chinese. An instance is quoted where a certain settler is said to have averaged a clear profit of £10 a week for six weeks, and to have at an earlier stage received no less a sum than £6 a week for a period of six months. The cabbages grown by this settler are said to command no less a figure than 4s. 6d. a dozen. Whilst he is seemingly on the road to affluence, a strange commentary on the apathy of other people is afforded by the fact that of the twenty blocks of land already surveyed for settlement, only nine are in actual occupation at the present moment. There was a tenth block occupied, but, because he found some other occupation more profitable, the settler had relinquished it, after devoting a considerable amount of labour to improvements on it. The fact is that some of the people of Bourke are highly sceptical as to whether the settlement at Pera will prove profitable ultimately.

"The Pera bore has a total depth of 1,054 feet, and yields a flow of 700,000 gallons per diem; the discharge-pipe is 10 inches in diameter, and with a view to releasing the sulphuretted-hydrogen which ascends with the water it is discharged into an elevated tank, whose capacity is 20,000 gallons. The water, having thus become aerated, is conveyed in a fluming which, in echelon form, traverses the experimental farm, and also passes between the settler's blocks, thus enabling each farm or orchard to secure whatever water it may require. For each 20-acre block the settler is required to pay £5 per annum and to make improvements. When the visitors arrived the water was flowing from a 20-inch head, which converted the flow into a charming fountain; and to illustrate the force of the flow the water was cut off at the head and released from a 2-inch nozzle which was fitted to the pipe directly above the bore. A great volume of water at once ascended skyward, and several visitors said that they would like to see the force of such a huge column tried in extinguishing some great fire. The present season is not the most favourable for visiting the farms and orchards, but on every hand there is abundant evidence of the fertility of the soil. Some people have expressed fear that the alkalinity of artesian water would have a prejudicial effect upon the growth of trees and vegetables, but such fears do not receive much support from the experience of settlers at Pera. At the Government farm there are 23 acres under fruit trees, 9 under lucerne, 6½ under wheaten hay, 1 under vegetables, and 1 under date palms. Altogether 30 date palms obtained from Algeria have been put in, and their growth has been most encouraging. The soil at Pera bore has proved especially well adapted to the growth of citrus fruits, peaches, and apricots, broom millet, amber cane, Kaffir corn, maize, and cotton. Broom millet grown at Pera has, it is said, commanded from £15 to £17 per ton in the metropolitan market. The total cost of the bore and all the works connected therewith was, the visitors were informed, less than £3,000."

FRUIT AND EGG PRESERVING.

The *Australian Vigneron and Fruitgrowers' Journal* reports as follows on experiments made by Messrs. Parker and Warner, with the above object in view:—

"Messrs. Parker and Warner, the patentees of a a fresh fruit and egg preserving solution, which is now being prepared and sold by a company in

large quantities, recently returned from a visit to Tasmania, where they demonstrated their method in a highly successful manner. They claim that by their process eggs and fresh fruits can be carried from the Antipodes to England and other countries as general cargo in the hold of a vessel, without the aid of refrigeration, guaranteeing that the same will open out as fresh as when packed and wholly unimpaired in quality. The fruit is coated with the solution, which is innocuous and transparent. It effects no alteration in the natural appearance of the fruit beyond giving it a little more glossy appearance. The natural gases of the fruit do not seem to be able to escape through the glaze composition. In fact, each variety of fruit is hermetically sealed. A gallon of the solution will preserve 50 cases of apples or oranges, lemons, pears, &c., or 40,000 eggs; and the cost is 35s. per gallon, or about 8d. per case. The analyst of the Technical College Laboratory, Sydney (Mr. W. A. Dixon), certifies that there is nothing deleterious or injurious in the solution, so that the fruit cannot be affected. When the skin is removed, the edible part is in its natural state. A few days ago we were shown some apples which were purchased in Sydney shops, treated with the solution on 6th March, and taken to Tasmania and exhibited at Huonville, New Norfolk, and Hobart, and they were perfectly firm. But the most surprising thing is that a cooking pear, grown by Mr. H. Sparks, Ermington (New South Wales), and coated with the solution on the 6th of January last, is still (1st July) in a thoroughly sound condition. Some ordinary white table grapes, treated by the process on the 10th of May last, have kept splendidly; in fact, they have the appearance and taste of freshly picked fruit. During the last few days, several delegates who attended the Intercolonial Fruitgrowers' Conference at Brisbane, have visited Messrs. Parker and Warner's manufacturing room at the Argyle Bond, and, after inspecting and tasting different varieties of fruit treated with the preservative, expressed their entire satisfaction with the method adopted. Messrs. Parker and Warner intend to buy some first-class oranges in the Paramatta district, and send them to London as ordinary cargo, in order to thoroughly prove the efficacy of their system. As far as we can judge, the preservative is destined to revolutionise the present costly and extremely unsatisfactory methods in the packing and transport of fruits to distant markets, and will eventually result in new markets being opened up, and an increase in trade of vast dimensions."

In this connection we (*Queensland Agricultural Journal*) have been expecting to hear of some method of hermetically sealing fruits by coating them with some innocuous but impervious solution. Many years ago the editor of this journal made a voyage from Callao (Peru) to Leith. Before leaving Callao, a quantity of oranges and cherimoyas (custard apples) were preserved by first wrapping each fruit in oiled paper. They were then covered with linen cloth and light canvas and dipped in pitch, a coating of about an eighth of an inch being applied. The voyage home lasted about six months, and the last of the oranges was opened on arrival at Leith, when the fruit was found to be quite sound. The oranges were not stowed in cases, but hung up to the beams of some empty cabins.

Further experiments will doubtless be made by the patentees, and we shall be pleased to be able to record successful results.

THERE appears to be no end to the troubles of Californian fruitgrowers. In recent seasons of abundance the markets for most kinds of fruit have been so badly glutted that prices have been unremunerative. This year, on the other hand, an early drought and cold north wind—at least in Northern California—have caused an amount of damage described in a report from a grower as "destructive, widespread, and irreparable." Pears are almost a failure, while cherries are shrivelled, and prunes have dropped off the trees wholesale. The weather has been also unfavourable of late to the farm crops.

PRICKLY PEAR FOR STOCK.

Mr. J. O'Shea, of Singleton, in a communication to the *Agricultural Gazette* of New South Wales, appears to bear out what we wrote in our first issue on the subject of prickly pears in Mexico. He says:—

"The experience in the troubles of drought that this district is undergoing at present tend to show that the Government committed an error in ordering destruction of the plant known as prickly pear. We were compelled to destroy them some years ago; and if we only had them back now, we would have no fear of losing our valuable dairy herd, which will take almost a lifetime to put in profitable order again. Those who have pears in this district are feeding them to cows in a boiled state, either pure or, better (those who have the means), mixing a little bran with them; and the cattle are not only living but are giving a very fair share of milk. They also make an excellent mess for pigs, and they are keeping alive all the pigs that are in this district—in fact, those who could find a little paddock of pears have shifted their cattle and pigs thereto, and erected boilers, from which a daily supply is served round to hungry and longing beasts. Those who cannot get pears, and they are many, have their cattle dying already with only the approach of winter. Some have shifted them to the coastal districts, which is certain death to cattle reared in this district. By the above you may see the error of eradicating the prickly pear."

To this, the editor appends the following note:—"There can be no doubt prickly pear has come in very handy during the present trying season, but stacks of hay or ensilage put aside for times of scarcity would look more business-like than clumps of this horrible pest."

We quite endorse this latter opinion. The prickly pear in Queensland is a pest and a sorry substitute for ensilage, the materials for which are always at hand during a fair season; and provident farmers will, by its means, not be driven to the last refuge of the destitute to keep their stock alive. If a dairy herd is worth keeping, it is worth providing for, not only in the matter of food but in that of proper housing.

GRAPES AND BEES.

It is generally believed among fruitgrowers that bees destroy grapes. The *California Fruit Grower* reports the result of an experiment made at the Indiana Experiment Station by Professor J. Troop, which proved the falsity of this belief:—"All defective berries were removed from a Worden vine when the fruit was well ripened, and a colony of bees placed in close proximity to it, and the whole enclosed with mosquito netting. The bees were thus confined for twenty-one days, and provided no further food. At the end of the three weeks the colony was removed and grapes examined, but not a single grape had been injured. Other observations showed that certain species of wasps first cut the grape-skins, and the bees would usually finish the work. He thinks it would be a very stupid bee that would not avail itself of such an opportunity."

BEES AND FRUIT TREES.

At one of the experiment stations (says the *Florida Times-Union*) it was decided to try an experiment to determine the value of bees to fruit trees. Two peach-trees were removed to a greenhouse, and a colony of bees was moved in and the trees were forced to bloom at midwinter. One of the trees was so protected as to prevent the bees from getting to it, while they were allowed free access to the other. During the time of bloom the bees worked industriously on the flowers of the tree to which access was had. As the season advanced, the fruit on both trees set and grew without appreciable difference until stoning period, when the fruit dropped from the tree that the bees had been kept away from, while that on which they had fed held its fruit until ripe.

TIN IN CANNED GOODS.

In a graduating thesis at Washington and Lee University, J. R. K. Cowan takes up the question of the presence of tin in canned goods, and his results confirm those of previous investigators along this line. He finds tin present in every can examined, including tomatoes, peaches, apricots, and sweet potatoes, in quantities of from 60 to 150 milligrams per kilo. Granting that this tin is present in a form which can be acted upon in the human system, and considering the large consumption of canned goods, it seems to follow that tin is less toxic than has been supposed and that it cannot be a cumulative poison. The maximum dose of tin is given as half a grain of chloride, but the amount of tin corresponding to this might often be taken into the system during a single meal. Very few cases of supposed tin-poisoning from eating canned goods have been reported, and it is probable there is little danger from this source. In no instance did Mr. Cowan detect the presence of lead.—*Science.*

When farmers shall have arrived at a proper estimate of the advantage of feeding and housing their stock, Queensland will perhaps be able to outdo the results attained in Great Britain as under:—

LIVE STOCK PER 1,000 ACRES OF CULTIVATED AND GRAZED LAND.

	Horses.	Cattle.	Sheep.	Pigs.
England ...	44	169	594	92
Wales...	39	180	810	65
Scotland ...	14	84	522	10
Great Britain	34	144	590	64

The low ratios of Scotland are accounted for by the great proportion of almost *waste* land in that country used for *grazing* purposes. The proportions of cultivated to total area are, approximately, three-fourths in England, seven-twelfths in Wales, and one-fourth in Scotland.

A profit of £1,000 a year on fifty-five cows is the kind of return which makes the dairy farmer anxious to know how it is done. This was shown at a meeting of a Farmers' Institute in Canada recently, when Mr. C. D. Telsar read a report of the returns from his Holstein cows for the year. One cow gave 1,500 gallons of milk, which at five cents per quart made $300. Ten cows averaged 11,600 lb., forty cows averaged 9,000 lb., and fifty-five cows averaged 8,000 lb. From his description of the methods of care and the buildings employed to attain these results, it was evident that consideration for the comfort and well-being of the animal is the primary object of attention at this place at least. The diet used consists of bran 6 lb.; peas, 2 lb.; corn ground on the cob, 3 lb.; ensilage, 50 lb.; clover, 8 lb., which, with other ingredients, brings the cost per cow per day to 14c. Taking the average yield of the fifty-five cows, each cow made a net profit of $109 (£21 16s.) after allowing for cost of keeping at 14c. per day, or a total for the whole herd of $5,995.—*Exchange.*

GERMAN LABOURERS ON HAWAIIAN SUGAR PLANTATIONS.

The *Tropische Landwirthschaft* (Berlin) reprints from the *Vossische Zeitung* the following:—"An interesting experiment will shortly be made here by the introduction of German labourers for the sugar plantations in the place of Asiatics. The German ship, 'H. F. Glade,' is on the way from Bremen to Honolulu, and takes 120 German labourers and their families, who will be employed on one of Messrs. Hackfeld and Co.'s plantations. This experiment is the more important, as hitherto it has been the generally accepted notion that white men are unable to do the plantation work now done by Asiatics. The Labour Commission of the State of California has gone to Hawaii to investigate the labour question there in connection with the coffee plantations, and to decide whether Californian labourers can be sent there. Various regulations are being tentatively made to supplant coolie by white labour, in order to protect the Republic from an invasion of Japanese."

SUGAR LANDS AT CAIRNS.

From the *Cairns Post* we learn that the whole of the land, 1,050 acres, comprising what is known as Letraille's selection, situated on the banks of the Mulgrave, has now been sold to sugar farmers, who are actively engaged in preparing the land for crops. Scrub-falling on this block of land is the order of the day, and the crash of falling trees is continuous. Mr. T. Bowen has 60 acres under cane on this land, and the following have cleared areas in preparation for planting cane:—W. J. Munro, 100 acres; J. Gordon, 60 acres; T. Swan, 60 acres out of 140; Mr. McElhone, 25 acres, and others who in the aggregate will total an additional 70 or 80 acres. It is anticipated that fully 600 acres of this land will be under crop in readiness for the 1898 season of the Mulgrave Central Mill, and that the following season will see the whole 1,050 acres under cane. When this takes place the directors would do worse than to follow the advice given by the Hon. R. Philp, "When you have got more cane than you can conveniently crush, go to the Government and ask for money to extend your mill, and I am confident it will not be refused."

An American horticultural paper describes the Casabanana (*Sicania oderifera*) as a "new fruit" of considerable value. The plant which produces it is represented as one of the most handsome climbing plants ever introduced, as well as a good fruit-yielder. In a suitable climate, it is said, the plant will climb to the height of 50 feet in one season, and it succeeds wherever the melon flourishes. The fruit is about 18 inches long and 3 inches in diameter, and of a brilliant red colour when ripe, while it exhales a strong pineapple fragrance. It is suitable for preserves, and, when unripe, for curry.

The balance-sheet of the New Zealand Farmers' Co-operative Association shows a profit of £11,692. This has been apportioned in a dividend of 6 per cent., and a 4 per cent. bonus on the called-up capital has been distributed to the shareholders.

The New South Wales Fruit Export Co-operative Company have declared a dividend of 10 per cent., and have placed £951 to the credit of the reserve fund.

The *Scottish Farmer* says:—"A Portobello dairy, in which one of the female milkers was affected with scarlet fever, has been proved to be responsible for the prevalence of the disease in the neighbourhood."

A report on the working and results of the *Woburn* Experimental Fruit Farm, established by the Duke of Bedford at Ridgmont, in 1894, has been written by the Duke and Mr. Spencer U. Pickering, and published by Eyre and Spottiswoode, London. The farm consists of 20 acres of a sandy loam, described as heavy, in spite of the large proportion of sand in it. Various experiments in methods of planting fruit trees, manuring, pruning, neglecting them, and allowing grass to grow around them, have been tried, and the tests as to growth, size of leaves, and yield of fruit are methodically stated. As the trees have not yet come into full bearing, the differences in yield are not as great as they probably will be hereafter; but some of the *results* are *already instructive.* It appears that the growth of the trees is affected by beneficial or injurious treatment to a much greater extent than the leaf-size. Indeed, except where the difference in growth approached 50 per cent., the size of the leaves was not affected. Careless planting and subsequent neglect had a great effect, the growth of the trees thus badly treated being in one year 93 per cent. less than that of trees well planted and properly cared for; while the leaf-size was 75 per cent. less, the total leaf area 84 per cent. less, and the crop of fruit in 1896 was less than 5 per cent. of the yield of the trees properly treated. The growth of grass around young apple-trees had a marked effect in reducing growth, size of leaf, and yield, the reduction of the latter being 71 per cent., though it is supposed that this was in great part owing to the drought of 1896. Weeds had a less injurious effect than grass. Neglect of cutting-back trees when planting them, resulted in a great diminution of

growth and leaf-size; but the relative advantages of cutting-back at the time of planting or in the following autumn are not yet clear. Different methods of summer and autumn pruning have not yet led to any striking conclusions. Root-pruning, on the other hand, produced immediate results in loss of vigour, which is not surprising, seeing that it was carried out in the year after the planting, when it could not have been needed. The manuring trials appear to have failed, in consequence of drought. It is astonishing to notice that trees planted in November grew much less vigorously than those planted in the following January or March, and probably this is due to accidental circumstances, as it is not likely that horticultural authorities are wrong in recommending autumn planting, after all their experience. Some experiments in the yield and size of berry of different varieties of strawberries will be interesting to fruitgrowers. The report is the first one, and it is to be expected that the systematic experiments and careful observations begun on the fruit farm will yield valuable results in the future.

It is possible that the estimate given in last month's number of the *Journal* of this season's output of coffee was much below what our correspondent has since been informed may be the return. But accurate information seems to be difficult to obtain. We will always gladly publish reliable information from the planters.

We take the following from an American exchange merely to show what sort of nonsense is occasionally written to foreign countries by persons whose habit is is to decry the country which supports them. It is an extract from a letter purporting to have been written by a Sydney resident to the United States:—

"You must not imagine from the preceding that we are deficient of men of enterprise. Instance the following: In our town of Paramatta three years ago some twenty public-spirited townsmen, to assist the fruitgrowers and relieve the glutted market, joined and formed a jam company. At the end of first year they reported a profit of 30 per cent. on capital, and issued a note to increase the capital fourfold. Thinking it was a good thing, I was inclined to take shares, but first went to the factory and saw the managers—an old man and wife, seventy years of age each, assisted by an elderly lady and young girl. I fancy the wife was boss. Machinery: Two pans, to contain about 100 [apples ?] each, and a paring machine. This quite satisfied me. I took no shares. The company continued a second year and burst up, and the stockholders lost their money. *The capital was* $1,000. Just imagine: To start a jam factory to relieve the glut on a capital of $1,000 [£200 about]! I may tell you in this company were a bank manager, doctor, lawyers, soft-goods man, and fruitgrowers. The above are facts, though I have treated the affair as a joke."

It is written in some American book: Fondness for the soil comes back to a man after he has gone the whole round of pleasure and business. The love of digging in the ground is among the last, as it is also among the first of our delights. It is as sure to come back to a man as he is sure to go under the ground and stay there.

SHOW FIXTURES.

Southern Queensland and Border Agricultural and Pastoral Association, Nerang ...	3 Sept.
Rosewood Show...	9 Sept.
Agricultural and Pastoral Society of Southern Queensland, Beenleigh	10 Sept.

We regret that by inadvertence the name of W. D. Armstrong, Esq., M.L.A., was omitted from the list of names of those gentlemen present on the invitation of the Minister for Agriculture (the Hon. A. J. Thynne) at the official opening of the Queensland Agricultural College on the 9th July last. Mr. Armstrong met His Excellency the Governor at Gatton, and drove him to the College. At the close of the proceedings Mr. Armstrong's carriage was placed at the disposal of the visitors for the drive to the College Railway Station.

Imports to Great Britain.

STATISTICS of certain produce imported into Great Britain during 1895, which could be exported from Queensland, but which are not yet exported in appreciable quantities:—

FREE IMPORTS TO GREAT BRITAIN.

Article.	Quantity.	Value.
		£
Bacon	4,063,418 cwt.	7,925,979
Hams	1,289,518 „	2,898,018
Butter	2,825,662 „	14,245,230
Caoutchouc	{ 237,957 „	2,874,219
	{ 103,596 „	885,959
Cheese	2,133,819 „	4,675,130
Maize	33,944,350 „	7,808,860
Cotton—raw	15,687,881 „	30,429,428
Eggs	12,722,586 „	4,003,446
Farinaceous substances	...	1,140,390
Flax	87,844 tons	2,998,778
Fruit—		
Almonds	121,120 cwt.	340,409
Lemons	1,165,490 bus.	365,320
Oranges	7,708,719 „	2,111,190
Guttapercha	48,077 cwt.	389,258
Honey	26,032 „	41,302
Nuts for oil, &c.	68,245 tons	768,783
Cocoanuts	285,016 cwt.	321,550
Olive oil	14,834 tuns	522,811
Palm oil	1,262,933 cwt.	1,320,690
Poultry and game	...	605,160
Rice	5,431,248 „	1,982,406
Silk—raw	1,585,835 lb.	1,002,206
Sugar, except beetroot	53,156,324 cwt.	31,058,923
Wax	45,851 „	194,047
Wood and timber, furniture, hardwoods, and veneers	133,486 tons	900,214
Spices—		
Cinnamon	1,645,340 lb.	48,001
Ginger	88,260 cwt.	167,101
Pepper	26,710,660 lb.	299,468

DUTIABLE IMPORTS TO GREAT BRITAIN.

Article.	Quantity.	Declared Values.
		£
Cocoa	42,769,307 lb.	1,296,190
„ Husks and shells	1,447 cwt.	467
„ Prepared	2,977,813 lb.	307,057
Coffee—raw	774,253 cwt.	3,777,423
Fruit—		
Currants	1,093,080 „	773,069
Figs	138,737 „	178,325
Raisins	711,241 „	888,769
Tobacco—		
Unmanufactured	72,879,623 „	2,097,603
Except cigars...	1,616,059 „	208,254
Wine in cask	13,557,661 gal.	3,073,819

SCHEDULE of some oversea imports in connection with agriculture during 1896, that are not sufficiently or might be produced in Queensland :—

Particulars of Imports.	Quantity.	Value.		
		£	s.	d.
Agricultural implements	2,440 pkgs.	16,675	0	0
Arrowroot	7,047 lb.	97	0	0
Bark	1,972 tons	11,872	0	0
Bran and pollard	8,612 bush.	449	0	0
Butter	1,003,680 lb.	43,075	0	0
Chaff	6,357 tons	34,558	0	0
Cheese	77,275 lb.	1,820	0	0
Chicory	69,756 lb.	597	0	0
Coffee	149,442 lb.	7,291	0	0
Cotton waste	433 pkgs.	1,723	0	0
" wicks	68 "	390	0	0
" piece goods	11,311 "	316,859	0	0
Eggs	307 "	120	0	0
Fibre, cocoanut	165 tons	1,392	0	0
" flax	30 "	432	0	0
" hemp	154 "	3,093	0	0
Flour	32,996 "	370,419	0	0
Fruit, bottled (quarts)	10,332 doz.	3,223	0	0
" " (pints)	18,489 "	3,339	0	0
" dried	480,899 lb.	9,995	0	0
" currants	1,144,200 lb.	8,024	0	0
" raisins	517,943 lb.	6,357	0	0
" green	250,624 pkgs.	65,729	0	0
" pulp	121 tons	2,579	0	0
Ginger, green	70 pkgs.	41	0	0
" preserved	110,305 lb.	2,255	0	0
Grain, barley	18,295 bush.	3,374	0	0
" pearl barley	19,514 lb.	113	0	0
" beans and peas	14,089 bush.	3,277	0	0
" split peas	101,258 lb.	513	0	0
" maize	13,498 bush.	2,169	0	0
" malt	147,474 "	47,676	0	0
" oats	88,484 "	11,556	0	0
" rice	7,448,761 "	42,633	0	0
" rye	485 "	110	0	0
" tares	82 "	36	0	0
" wheat	863,469 "	179,956	0	0
Hay	693 tons	3,826	0	0
Honey	2,642 lb.	64	0	0
Hops	353,910 lb.	15,185	0	0
Lard	955 lb.	26	0	0
Maizena and cornflour	414,925 lb.	4,823	0	0
Meal, linseed	...	...		
" oat	299 tons	6,514	0	0
Milk, condensed	1,240,557 lb.	26,494	0	0
Nuts, almond	34,255 lb.	1,329	0	0
" Barcelona	15,960 lb.	289	0	0
" cocoa	306 pkgs.	165	0	0
" walnut	2,952 lb.	134	0	0
Onions	2,660 tons	21,905	0	0
Pepper	102,652 lb.	1,820	0	0
Potatoes	19,271 tons	82,328	0	0
Preserves	30,549 doz. lb.	7,455	0	0
Tapioca	489,313 lb.	2,047	0	0
Tobacco, manufactured	627,845 lb.	62,738	0	0
" unmanufactured	64,046 lb.	2,378	0	0
" cigarettes	35,900 lb.	9,385	0	0
Vegetables	7,868 pkgs.	5,706	0	0
Vermicelli	19,480 lb.	333	0	0
Wine	37,104 gals.	24,654	0	0

There are, in addition to the produce enumerated above, other products of Queensland which as yet have not been prominently brought before our

exporters. Amongst these may be mentioned tinned fish and turtle. Our seas and rivers teem with excellent fish, which only await the advent of some enterprising capitalist to be turned into a source of considerable revenue. Linseed and castor-oil also deserve attention. The latter is derived from a plant which grows on any soil; the most wretched rocky soils will produce luxuriant crops of the castor-oil bean, and cultivation is scarcely required. Vanilla is another product which might be profitably grown in the far Northern districts, and nutmegs would find a congenial home on the Herbert and other Northern rivers. It may truly be said that there are very few products of the soil which cannot be grown to a profit in this colony. Cotton and maize would not pay to export; but Queensland cotton during the American War was exported in large quantities, and realised over 1s. per lb. for Uplands and a higher price for Sea Island. Another product which should receive attention is camphor. The camphor laurel adapts itself apparently to any climate here, and thrives most luxuriantly. The camphor forests of Formosa are being destroyed in the same manner as the rubber-trees of the Orinoco, and it would be advantageous to grow these trees in a colony so eminently suited for their culture. Dye woods and tannin bark and nuts should also figure in our exports. Only lately we have heard of the Divi Divi nut, which, according to Mr. E. Cowley, of the Kamerunga State Nursery at Cairns, thrives well and produces crops from which a net profit of 18s. per tree may be derived per annum. This tree thrives on any soil. Its dried pods are worth from £10 to £12 per ton in the London market. It may be planted on poor, overcropped, weed-encumbered land from which no ordinary cultivation would produce a profitable crop.

Ginger, again, is a crop which adapts itself to many Queensland soils and climates. In the Blackall Range it is being grown to a profit with very little labour. If our farmers could be induced to make a commencement with some of these plants in their spare time, their children would bless their forethought. They should emulate the example of the old German farmer. At the age of eighty years he began to plant an orchard of fruit trees. When his little grandson asked him if he ever hoped to reap the fruit of his industry, he replied that he was planting for posterity, as his forefathers did for him.

Farm and Garden Notes for September.

GROWING crops should be kept clean, and those requiring earthing-up, should be attended to. A vigorous use of the hoe, horse or hand, will tend to save future labour. Sow maize, sorghum, imphee, prairie-grass, panicum, tobacco, and pumpkins. Plant potatoes, and earth-up those already growing. Sweet potatoes may be planted if the cuttings can be obtained. Cane-planting should be now carried on vigorously. Plant out coffee, ginger, arrowroot, and yams.

THE Kitchen Garden will well repay all the attention now bestowed upon it. This is the month for general sowings of most kinds of vegetables. Plant out rhubarb, Jerusalem artichokes, seakale, and asparagus. Transplant cabbages, cauliflowers, eschalots, &c., for a succession. Melons, cucumbers, vegetable marrows, custard marrows, tomatoes, and egg-plants may all be sown. Rosellas should also be sown in sheltered spots. Keep the crops clean, and manure with liquid manure. It is a good thing to sow newly dug beds with salt. The action of salt on the soil is not understood, but applied as a top-dressing it appears to check a tendency to rank growth. Cabbage especially is benefited by salt, but used too liberally it leads to the formation of a pan and renders soils sterile.

IN the Flower Garden continue to plant bulbs as directed last month. Protect the plants as much as possible from cold westerly winds, which may still occur. Keep a good lookout for slugs, which should be destroyed whenever detected. Toads are very useful helpers in the garden and bush-house, and should be encouraged to take up their quarters there. They are perfectly harmless in spite of their ugliness.

FILL up all the vacancies with herbaceous plants. Sow zinnia, gailliardia, amaranthus, coxcomb, balsam, sunflower, marigold, cosmea, summer chrysanthemum, coreopsis, portulacca, mesembryanthemum, calendula, marigolds, &c.

PLANT out bulbs, as dahlias, gladiolus, amaryllis, tuberoses, ismene, crinum, pancratiums, &c., also cannas.

Orchard Notes for September.

By A. H. BENSON.

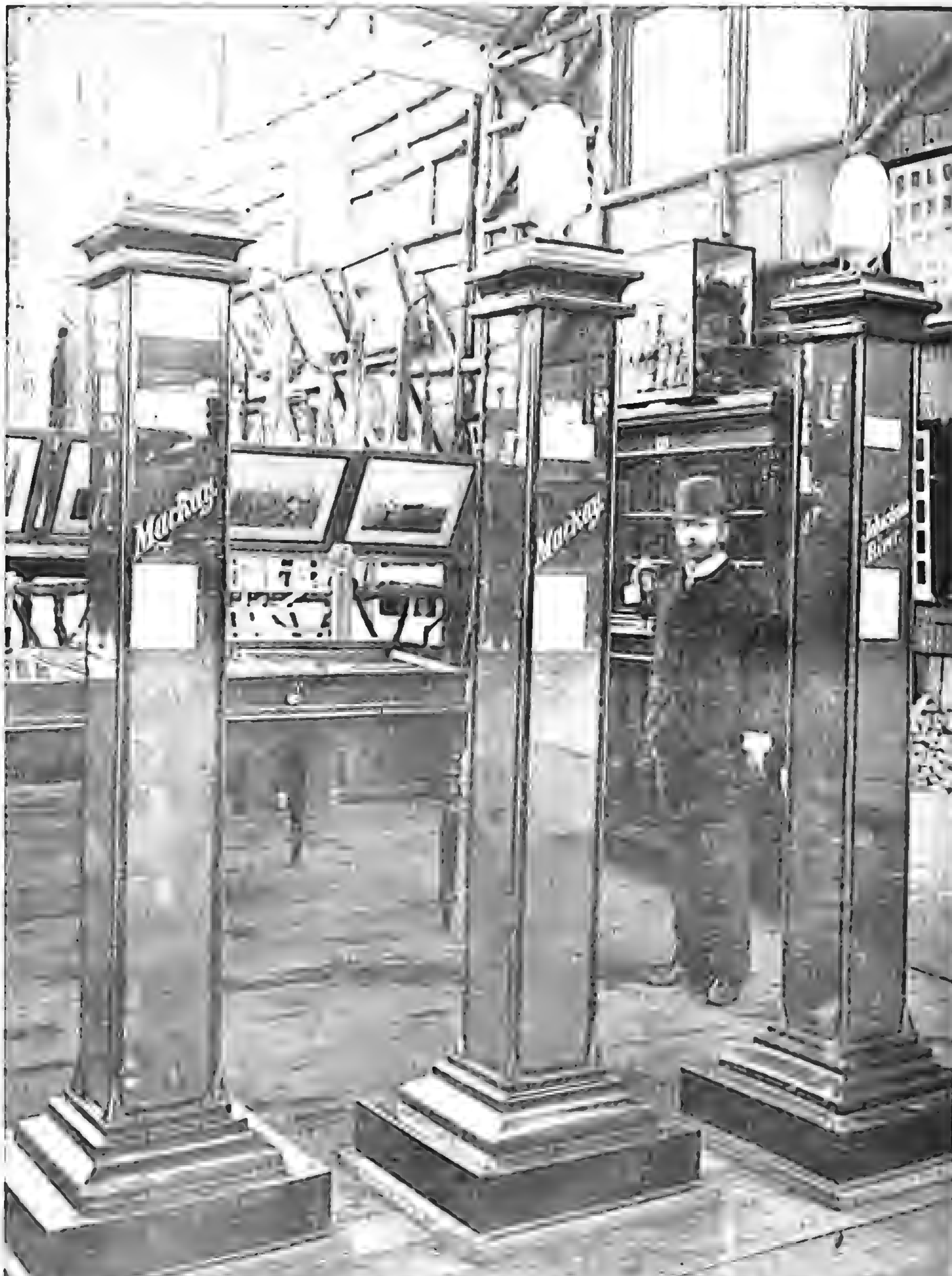
The planting and pruning of all deciduous trees should have been completed even in the coldest districts by the end of August, and during the present month the orchardist should disbud and thumb-prune the young trees as soon as they start out into growth. Judicious thumb-pruning is necessary in order to reduce the number of branches, only those buds being allowed to develop into branches that will be required to form the future head of the tree, all the rest being either removed or, better still, pinched back and converted into spurs which will eventually bear fruit and which, meanwhile, will produce a tuft of leaves that will tend to strengthen the branch and to protect it from sunburn. Spraying should be continued during the month in the case of deciduous trees attacked by fungus diseases, such as the shot-hole fungus or rust of the apricot and the Windsor pear blight of pears, the material used being Bordeaux Mixture. Where leaf-eating insects of any kind are troublesome, a little Paris green—1 oz. to 10 gallons—should be added to the Bordeaux Mixture, the spraying material being then both an insecticide and fungicide, and two pests are destroyed by the one spraying. Vines that have not been treated for black spot, as described in the Orchard Notes for August, should be treated at once; and vine-planting should be done during the beginning of the month, though if the cuttings have been kept in a cold place planting can be continued all through the month. In planting grape cuttings, see that the cutting is always planted firmly, and that the soil comes into direct touch with it all round, as, if not, it is very apt to dry out. Plant the cutting with the top eye just on a level with, or rather slightly below, the surface of the ground, not with 6 inches or more of the cutting sticking out of the ground, as the nearer to the ground the main stem of the vine starts the better the vine will be, and the easier will be its subsequent training.

Orange-trees will be in full blossom during the month; and in the earlier districts, the young fruit will probably be ready to treat for Maori or rust towards the end of the month. Maori is caused by a very small mite which begins its attack on the young fruit when it is about the size of a marble, though the injury it causes is seldom noticeable till the fruit begins to ripen. Spraying the trees with a mixture of sulphur and soft soap, or with a weak solution of sulphide of soda, or dusting the trees with fine sulphur will destroy these mites. During the end of the month, pineapple and banana suckers may be set out during favourable weather in the earlier districts, but it is not advisable to plant out too early, as they do not root readily till the soil is thoroughly well warmed. Orchards and vineyards should be kept well cultivated during the month, as if there is a dry spring the success of the crop will depend very much on the manner in which the orchard is kept, as the better the orchard is cultivated the longer it will retain the moisture required by the trees for the proper development of their fruit. Quickly acting manures, such as sulphate of potash, sulphate of ammonia, and superphosphate, can be applied to fruit trees during the month if there is any suitable showery weather, but should not be applied during either a very dry or very wet spell. Fruit trees should be mulched, and when cow-peas are required for mulching they can be planted towards the end of the month.

During the month a careful examination should be made of all fruit to see if any contains larvæ of fruit fly; and if such are found, they should be destroyed, as if extreme care is taken during this and the two following months to destroy the larvæ of all fruit flies, whenever and wherever found, this great curse of the fruitgrower would be greatly reduced, as it is on the careful destruction of the earlier broods of flies that the saving of the main crop of fruit will principally depend. Though the first damage caused by the flies is comparatively insignificant, they reproduce themselves so rapidly that a few mature insects in the beginning of the season become many thousands before it closes.

Answers to Correspondents.

THE article on Rubber in the Botanic Garden at Palmerston, to which allusion was made in our August number, did not state what variety was being grown. We will endeavour to give the required information in our next.



Soil Exhibits—Agricultural Department,' International Exhibition, Brisbane. 1897.

Registered at the General Post Office as a Newspaper.]

THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. A. J. THYNNE, M.L.C.,

SECRETARY FOR AGRICULTURE.

VOL. I. PART 4.

OCTOBER, 1897.

By Authority:
BRISBANE: EDMUND GREGORY, GOVERNMENT PRINTER.

1897.

CONTENTS.

CONTENTS.

Progress at the Queensland Agricultural College.

Work at the College is progressing apace under the management of Principal Shelton and his staff. Less than fourteen months ago, the site was a virgin forest. There was not a fence nor a building on the whole property. To-day, a visit to the College discloses a very different state of affairs. The principal buildings have already been fully described in the first number of this journal. We wish now to show more particularly what has been and is being done to make the institution a practical educative establishment. The whole site, comprising 1,672 acres, is enclosed by a substantial fence, and for the present has been subdivided into six sections, all of which are securely fenced. The principal work then undertaken was clearing and getting the land ready for cropping. Last year the time was too short to allow of any extensive planting, but a beginning was made with maize and vegetables—the former was utilised in the silo, and the latter for home use and for sale of any surplus. Since then, nearly 300 acres have been broken up. Of this, 50 acres—possibly 100—will be put under maize, and the balance will be cropped as considered most advantageous. Almost the whole of the work has been performed by the students, and it is gratifying to notice the zeal and ardour with which these young men throw themselves into their work, some portions of which, such as road-making, stumping, &c., are very laborious. They take a hand in all the work, but by a judicious system of "rotation" they are prevented from being wearied of any particular employment. For instance, a squad of six, eight, or ten will be engaged in class work under one of the masters during the morning. These in the afternoon go into the field, and the working party of the morning forms the classes for the afternoon. At 6 a.m. the bell rings, and in a short time the hive is astir. Tools are served out, and all but the ploughing squad get to work at some useful employment near the house until breakfast time, 8 a.m. Meanwhile the horses have been fed and groomed, the cattle and swine attended to, and all is ready for the solid business of the day directly after the morning meal, which is substantial, well cooked, and neatly served. It should be mentioned that at 7 a.m. Mr. Shelton holds an "assembly," at which all are present, unless specially exempted. At this assembly the orders of the day are given out, and the students receive ten minutes of wholesome advice and instruction from the Principal on the subjects of morality, deportment, duties towards each other and to the authorities, &c.—an excellent practice which cannot fail to have a good effect on the present and future lives of the students.

The favourite employment is ploughing, and it is remarked that should any lad, by an oversight, be passed over when his turn at the stilts has arrived, he promptly notifies the fact to the Principal, and so gets his grievance redressed. We noticed one young lad, not of very powerful physique, ploughing with three horses, and doing very creditable work. Mr. Shelton said that this student nad never had a plough in his hand before that day. He will probably be heard of by-and-by as a prize-taker at ploughing matches. Several of the pupils are engaged in building a frame-house for the overseer, and the work is very well done. Nearer home, two lads are engaged, under the superintendence of Mr. Quadling, the overseer, in pulling down trees by the help of the "forest devil," and they make very short work of it; several acres have been cleared in this manner since the introduction of this valuable implement. It is worked by one horse, one man, and two students.

The road-makers are hard at work forming a roadway leading straight from Lockyer Creek up to the College. This is being blinded with sandstone taken from the well lately sunk. Others are forming a road from the College quad. to the main Gatton road. It is quite evident that all work in this line is being done on a settled plan with a view to future convenience.

On reaching the vegetable garden and orchard, we find Mr. Gorrie, the horticulturist, hard at work with his squad of gardeners, cultivating the crops of cauliflowers, cabbage, peas, &c., &c. Some are hoeing between the rows; others ploughing with a reversible mould-board plough; others watering, gathering, and packing vegetables in crates, and collecting damaged vegetables for the pigs. Nothing is wasted. There are no unsightly heaps of decaying cabbage leaves, pea haulms, &c., but all is carefully carted away to be utilised in some form or other.

One of the, at present, most interesting and valuable experiments being made is that now being carried on with wheat.

There are 345 different varieties of wheat sown on the experiment ground. These were all sown by hand between the 4th and 8th June. Each variety is marked and numbered, and its name, date of sowing, peculiarity of growth, &c., are all entered in a book specially kept for the purpose, so that any variety can be at once found and identified. They have made the most remarkable growth—in fact, the season has been so favourable and the soil so rich that the rank growth has had to be repeatedly checked by a merciless use of the hoe, and still there is a superabundance of growth which is undesirable. This is also the case on all the farms we visited at Laidley and Forest Hill, where some of the farmers are cutting it down to enable them to get a good return from the after-growth.

A very large proportion of the varieties sown is either rust-proof or rust-escaping; the difference being that the rust-proof or, rather, rust-resisting kinds are rarely, if at all, affected by rust whenever sown, whilst the rust-escaping varieties are those which come to maturity early and thus escape the disease.

It will be instructive to wheat farmers to note some of the varieties sown, many of them entirely new to Queensland, and which may prove to be valuable, productive kinds, well adapted either for milling purposes or for hay.

Each variety has a certain number of rows devoted to it, and where only two rows are sown it is an indication that that particular wheat is not of very great value so far as is known at present. We first observe six rows of Thomas' Rust Proof, which Professor Shelton says will prove a good wheat for both farmer and miller. Following these come eight rows of Venning's Rust Proof, a very excellent sort—a true rust-resisting wheat; but it is open to the objection of having a weak straw, which will affect the cutting very seriously. Mr. Shelton expresses himself as very favourably disposed towards a variety of rust-resisting wheat named Buckley's. This, however, should be grown in comparatively poor land.

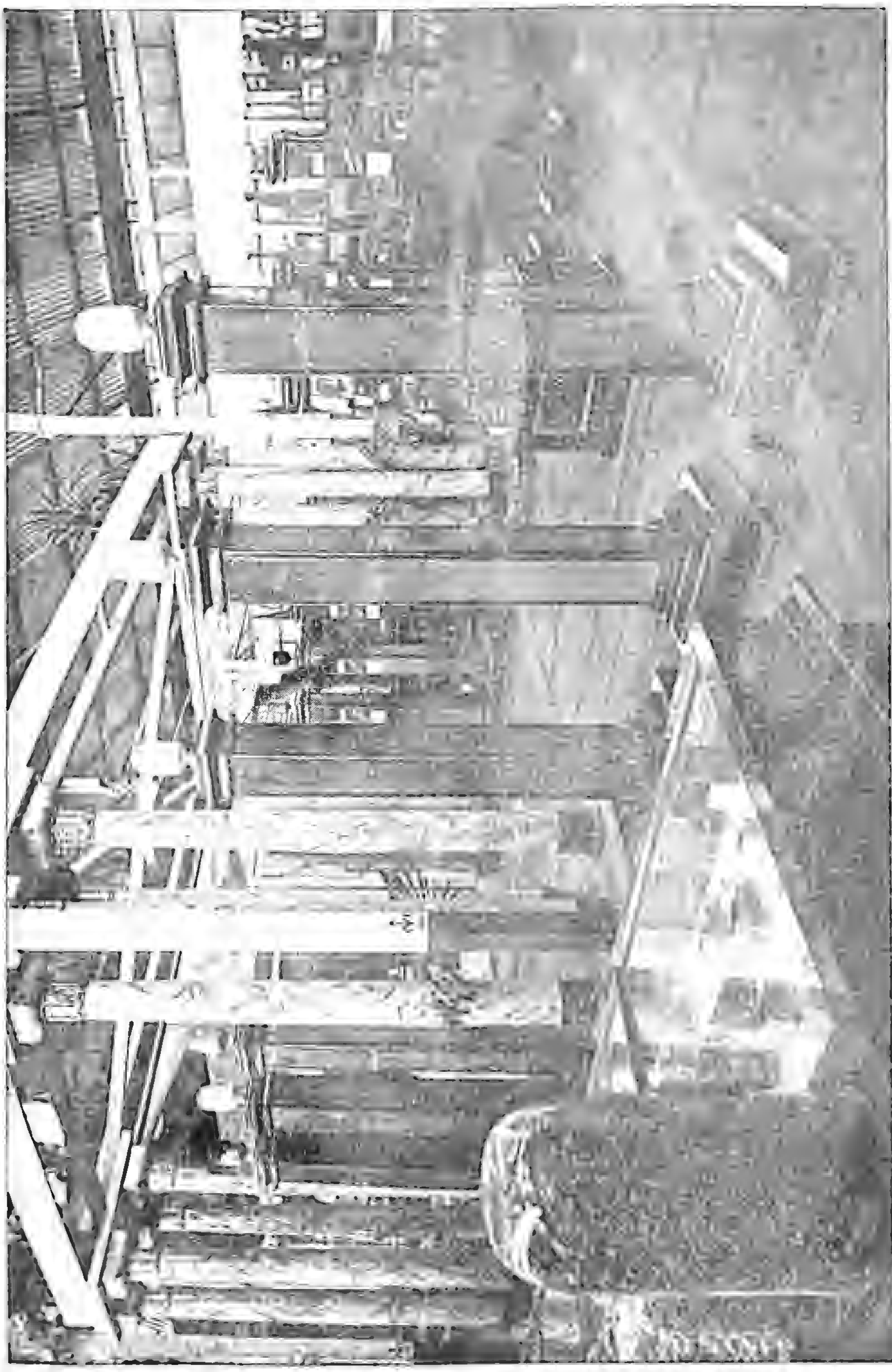
After these come twenty-seven varieties of true rust-resisting wheats, amongst which are Wheedon's, Robin's, Austin's, Clark's, Blount's, Leake's, Brigg's, Australian Wonder, and Blount's Lambrigge, &c., &c. Another good sort is Inglis' Battle Field, so named on account of its having been discovered on some ancient European battle-field.

No. 18 Blount's Rust Proof is a remarkable-looking variety, with a peculiar creeping habit, an enormous stooler, and a sort which would probably be worthy of cultivation for hay, for which, owing to the large amount of flag, it would be well suited.

No. 22 is again a Battle Field wheat, but differs from that above mentioned as Inglis' Battle Field. It is really a South Australian wheat, but is not very well known there. It is a very promising kind, with a strong straw.

The next lots to come under observation are eighteen varieties known as "Marshall's." These were made a specialty by Mr. Marshall, of South Australia, who was most successful with them.

The most striking wheats are now seen in the Indian rust-resisting varieties. These stand erect, and are far in advance of the Australian, Russian, Swedish, and French sorts—in fact, they are already coming into ear, and should be ready for harvesting in another six weeks. It should, however, be remarked that, as these wheats came originally from a hot climate, they should be grown here under similar conditions. This is the true secret of success in



Soil Exhibits—Agricultural Department, International Exhibition, Brisbane, 1897.

growing the pure Indian wheats or Farrer's Cross-breds. They should be grown below the Range, where greater results would be obtained with them than if grown on the Downs. They are rust-escaping, with a strong straw, and most of them are bearded, but the following are all good old bald (unbearded) sorts: Indian Fife, Pearl, and Early, which are well suited to the climate and soil of this colony.

Another of the Indian sorts, known as "Indian Hard," was procured by Sir Thomas McIlwraith when in India, and sent by him to the Department of Agriculture. It has a considerable amount of flag, and hence should be a good variety to grow for hay.

There are several other kinds of Indian wheats in this experiment plot, but nothing is as yet known as to their qualities for milling or hay-making. This will, however, be very shortly determined, as they are all early, and will be ready to cut by the end of September.

One variety called an Indian wheat, but which really came from Africa, is an old favourite on the Downs, and is the best of all of these wheats. The grain is of excellent quality, and is especially liked by millers. Next come several varieties of Swedish wheats, which are not, however, in Professor Shelton's opinion, likely to find favour with farmers. A few rows of Town and Country, another Downs favourite, look very promising. This is a very superior wheat, and will yield, in fair seasons, from 35 to 45 bushels per acre.

A little-known wheat here is Sunrise. This variety stools well. There are few facts known concerning it, but it appears to be a very early variety, and may possibly prove productive.

King's Jubilee is one of the very earliest wheats grown, with a beautiful plump grain, white as chalk, but the straw is weak, and it takes the rust, unless sown early in the season. Its chief defect is the weakness of the straw.

Hunter's White, Finley's, and Purple Straw might well be grown for a hay crop.

Of late years farmers have gone in steadily for sorts which, by their growth, give the best promise for hay. All wheats now grown in Queensland have little flag, and are deficient in strong qualities, thus being almost useless for hay-making. There is a great demand amongst the farmers for varieties suitable for hay-making purposes, like Allora Spring, Belatourka, and Canning Downs. Those grown now are lacking in flag, and are good for nothing but the grain.

Allora Spring is growing most luxuriantly alongside of Finley, a wheat grown by Professor Shelton twenty-five years ago in the State of Kansas (U.S.A.) It (the latter) will, however, do no good in this colony.

A productive wheat is Mexican Spring. It also resists rust.

Blount's No. 1 Bearded is really an unproductive "bald" variety.

Some Russian wheats are being experimented on, but they are already pronounced to be worthless, at least for Queensland. Still, an Odessa wheat, owing to its creeping habit, is a good sort, but even it will do little good here.

On Dutoits Mr. Shelton is ominously silent.

Farrer's Crossbred, known here as "Yandilla," is evidently weak in the straw.

The Tenterfield Red is a good milling wheat, as red wheats go. It is excellent for hay-making, as it flags and stools well.

A hybridised wheat, a cross between Fife and Etawa, introduced by Mr. Marshall, promises to be a good variety.

The next few rows are occupied by Red Indian King, one of Farrer's crosses. Another of the latter, known as "Gayndah," is a good promising kind, as are also Roma (Farrer's Crossbred) and Valala, never yet distributed here.

A French wheat, Mouton, finds no favour at the College. It is of far too "creepy" a nature.

Purple Straw is a great favourite down south. It is the most productive wheat grown there, but it is not proof against rust.

The Hercules has only been grown here for one year, and therefore little can be said about it, as a single year proves nothing.

Budd's Early is a more rust-resisting wheat than Allora Spring, and has had a great run in the colony. It is of much better quality than the latter sort.

There is a large number of wheats in another experiment plot, but they are principally duplicates of the above-mentioned. The method adopted for improving the varieties of wheat is to cull out all the best seeds from the strongest heads likely to contribute strength to the subsequent plant, and to cull only from a true strain.

One matter in connection with these valuable experiments with wheats is worthy of notice. There is not the slightest sign of rust in any single variety, and, so far as the Indian wheats are concerned, they are beyond the stage when they might be affected by too much rain.

From the wheat we move on to a 10-acre field of potatoes. These are just appearing above ground with very few misses. The soil being exceedingly rich and friable, a heavy crop may be expected with anything like a favourable season. In this same section, the nucleus of an orchard has been planted. The trees already established consist of well-selected sorts of peaches, persimmons, Japanese plums, guavas, mandarins, apples, pears, &c. A vineyard has also been started.

In the vegetable garden, which is under the charge of Mr. Gorrie, ample evidence is given of what can be effected by skilful management. Magnificent cauliflowers, superior to the best imported, and cabbages of phenomenal size are successfully grown. Brussels sprouts, broad beans, peas, rhubarb, and asparagus are all looking healthy. A large bed of strawberries has been planted, and, although only in their first season, are bearing well, and are rapidly ripening. No manure is required on this rich soil, but plenty of water and constant cultivation have resulted in splendid returns. The students do the whole of the work under Mr. Gorrie's superintendence, and take evident pleasure in the results of their labour. Water is pumped up from Lockyer Creek, which runs just below the garden, and can be supplied *ad lib.*

Besides the crops mentioned, which are either experimental or preliminary to permanency, there is a nice patch of rye for green feed for the stock.

Lucerne is just coming up, and an experiment is being made with a new kind of vetch.

The areas at present under crop are—Orchard, 8 acres; vegetable and fruit garden, 6 acres; wheat and rye, 4 acres; lucerne, 3 acres; potatoes, 10 acres; whilst, as before stated, from 50 to 100 acres are ready for maize, and 200 acres are now being harrowed and cross-ploughed.

The College dairy herd has representatives of four milking breeds—Holsteins, Jerseys, Ayrshires, and South Coast cattle—in all, about fifty head. They are well-bred, quiet cattle, and take very kindly to their diet of chaffed maize-stalks from the silo and green rye. They look sleek and contented, and yield ample supplies of milk for College use. The newly arrived Jerseys have proved a fortunate investment—five calves having been dropped since arrival, all of them heifers. It has been decided that all surplus stock of bulls shall, at the proper time, be placed on the market for sale by auction, and will be sold to the highest bidder. This will enable farmers to procure undoubtedly good cattle at reasonable prices.

Next year there will be increased facilities for the study of particular branches in the science and practice of agriculture. There will be a splendid laboratory excellently equipped, which is expected to be in full operation before the end of the year. All is ready for the construction of the building, and for the completion of its equipment. This will be under the direct charge of Mr. J. C. Brünnich, Agricultural Chemist of the College.

The dairy—the fittings and appliances for which, such as cream separators, pasteurizer, cheese vats, and presses, &c., are all ready—will be begun at once. This will furnish practical instruction in the use of modern dairy machinery

and in the manipulation of butter and cheese. The house at present occupied by the overseer, Mr. Quadling, will be assigned to Mr. Brünnich, and the former will occupy a neat cottage now being built by the students.

The future work in the building line is planned as follows:—The finishing of the piggery; the pigs are now running in a large yard, to which will be added the necessary accommodation for brood sows, boars, &c., &c. A cottage to be built for the herdsman, of which plans have already been prepared. A large barn to be erected before another winter. Plans are contemplated for a building which will have accommodation for thirty head of cows in the basement, besides stalls for bulls. There will also be a gangway overhead for the reception of hay and corn, which, on unloading from the carts, may be elevated into the barn and supplied to the animals by gravitation. Then there is a new silo to be built, different from the present one, which is rectangular, whilst the new one will be round.

Whenever a spare moment can be found, shade and fruit trees are planted on the ridge on which the main buildings stand, and a commencement has been made to beautify the immediate neighbourhood of the College and of Professor Shelton's house, by planting rose-trees and putting in cuttings of flowering plants. An unlimited supply of excellent water has been struck in a well sunk at the foot of the ridge, which obviates all necessity for carting water from the Lockyer at a considerable expenditure of time and trouble.

The studies of the students are presided over by Professor Shelton, Messrs. Brünnich (chemistry), H. Schmidt (science and bookkeeping), and Pitt (surveying and engineering); whilst for field operations and horticulture, Messrs. Quadling and Gorrie are the instructors.

Taken altogether, no students could have a more enjoyable and instructive, if somewhat laborious, life. Ample opportunity is given to them, by means of a large area of splendid soil, the latest improved machinery, the best of stock, and the most able instructors in their several branches, to obtain a first-class scientific and practical agricultural education, which will not only benefit themselves in after-life, but also their neighbours in whatever part of the colony they may hereafter elect to settle in.

Ensilage of Potatoes.

The experiment of placing potatoes in the silo has not, we believe, yet been tried in Queensland. It will, therefore, interest farmers to know that the trials made by the French scientists, M.M. Vauchez, Marchal, and de Monicault, not only with the potato, but also with the beetroot, have given surprisingly satisfactory results. From the *Journal of the Board of Agriculture* (London) we learn that, in these experiments, potatoes buried in a silo of crimson clover (*Trifolium incarnata*) acquired the characteristic colour of that plant; as well as the smell developed by fermentation. The tubers were much flattened by the heavy pressure to which they had been subjected; their cohesion also was greatly modified, and it was quite easy to pull them to pieces. The potatoes were examined microscopically and chemically by M. Girard, who ascertained that they had been cooked during the process. Thus MM. Vauchez and Marchal appear to have demonstrated the practicability of this method of cooking potatoes for fodder. The temperature in a silo of green fodder plants rises to nearly 160 degrees Fahr.; the potato is automatically cooked, and acquires the property of being easily digestible, which is requisite for its consumption by cattle.

That a high temperature (about 160 degrees Fahr.) is necessary, is shown by an experiment carried out by M. Mir, who, in order to determine whether maize, in spite of its size, could be preserved without being cut up, placed large quantities of the entire plant (stalks, leaves, and cobs) into a silo, and enclosed also about a ton of potatoes in the centre. On opening the silo, the maize and potatoes were both perfectly good. The tubers were flattened similarly to those in the experiment already mentioned, but they were more cohesive; moreover, the cooking appeared to be less advanced, and upon examination this proved to be the case. The reason of the difference was that the large entire stalks and cobs of the maize necessarily diminished the tight pressure, the temperature was not so high as in the compact mass of clover, and consequently the potatoes were not so well cooked.

Chemical analysis showed that the potatoes put into the clover silo had been less desiccated than in the maize; but the most striking differences were, on the one hand, the quantity of matter rendered soluble by the fermentation of the clover, and, on the other, the high percentage of starch cooked in the silo, consequently rendering the potatoes easily assimilable. It may be noticed also that only mere traces of dextrine and soluble starch were found in the potatoes from the maize silo, while the normal insoluble starch amounted to nearly a third of the whole constituents. M. Girard concludes that the same results would have been obtained in the maize as in the clover under similar conditions of temperature, pressure, and moisture.

These experiments have also led to another important result. It appears that, when taken out of the silo, these crushed potatoes give off their moisture very rapidly after exposure to the air, and are transformed into a hard substance containing only some 15 to 20 per cent. of water, in which condition they may be kept for a long period. When required for feeding purposes, it is sufficient to soak them in water for a while, which causes them to swell and absorb the moisture until they contain from 60 to 65 per cent. of water, and thus regain their softness and digestibility.

M. Tisserand communicated the results obtained by the ensilage of raw potatoes by M. Courmouls-Houlès. The latter took a mixture of several kinds of raw potatoes, chopped, with the addition of 2 lb. agricultural salt per 1,000 lb. potatoes, and put them into a silo weighted with about 25 cwt. per square

yard. The total cost of washing, chopping, putting into silo, and weighing 50 tons of potatoes was £3, or about ¾d. per cwt. The silo made on 20th November last was opened on 22nd January (sixty-two days later). The height of the silo at the time of erection was 5½ feet, and on 22nd January it had sunk to a little over 3 feet. The temperature of the mass was 39 degrees Fahr. at the commencement of the experiment, 42 degrees on 1st December, and 50 degrees on 22nd January. On taking out the potato pulp, it was found to have retained its whiteness, but the parts exposed to the air afterwards blackened slightly. Cattle ate this potato pulp greedily, either alone or mixed with undecorticated Egyptian cotton-cake. The experiments are to be continued.

M. Vogué read a third note on experiments made by M. de Monicault, who placed beetroot and potatoes in a silo of fodder maize. On opening the silo, neither beetroot nor potatoes had changed their appearance, although the tubers could be easily divided, as if they had been boiled in water. Analysis showed 4·5 per cent. of sugar in the beetroot. Distillation gave no trace of alcohol. As beetroot contains on an average 12 per cent. of crystallisable sugar, it would appear that two-thirds of the sugar had been lost in the ensilage. No soluble starch, dextrine, glucose, or alcohol were found in the potatoes; and ensilage appeared to have caused the desiccation of the tuber without having cooked it.

Experiments in Feeding Swine.

In the *Journal of Agriculture* (London) for March, 1895 (Vol. II., p. 444), some notice was given of the experiments in feeding swine, carried out at the Dairy Institute of Proskau (Silesia) in 1894. These experiments have been continued, and an account of the results obtained during 1895 is given in the *Landwirthschaftliche Jahrbücher* (Vol. XXV., Part III.)

The conclusions which appeared to be deducible from the experiments of 1893-4 were, that too much maize was injurious to pigs under six months old; owing to the formation of bone proceeding less rapidly than the development of fat, the bones were unable to sustain the weight of the body, and the limbs became stiff. No evil results followed from feeding with crushed barley. The question thus still remained to be determined, whether the maize was in itself injurious to young pigs, or whether it was deleterious only when given in too large quantities. A further point requiring elucidation was the best method of preparing the food, and data were also required to ascertain the value of fresh whey. Finally, with the view of discovering a fattening food containing a higher percentage of albumen, but less nitrogenous than cereal fodder, brewers' dried grains were included in the experiment.

To test these various points, four pairs of pigs (each pair consisting of a boar and a sow) were selected, all eight being born of one sow on the 5th April, 1895, and all being of about the same strength. The experiments commenced on the 20th May, the boars having been cut two days previously. For the first four weeks (until the 16th June) all alike received $5\frac{1}{2}$ lb. of skim-milk and $6\frac{1}{2}$ oz. of crushed barley daily in five meals.

The second period (17th June to 28th July) marks the transition from barley to maize and brewers' grains. The individual pairs were now fed separately, and in such manner that the amount of barley was diminished week by week, the crushed maize (or brewers' grains, as the case might be) being correspondingly increased. At the same time, potatoes and whey were included in the rations. The amounts given daily to each animal (in five meals) from the 28th July to the 8th September were as follow:—

Pair	I.—8·8 lb. skim-milk,	1.1 lb.	scalded crushed maize,		$2\frac{3}{4}$ lb. potatoes
,,	II.—8·8 lb. ,,	,,	uncooked	,,	,, ,,
,,	III.—8·8 lb. ,,	,,	scalded	,,	$8\frac{1}{4}$ lb. whey
,,	IV.—4·4 lb. ,,	,,	brewers' dried grains,		$5\frac{1}{2}$ lb. potatoes.

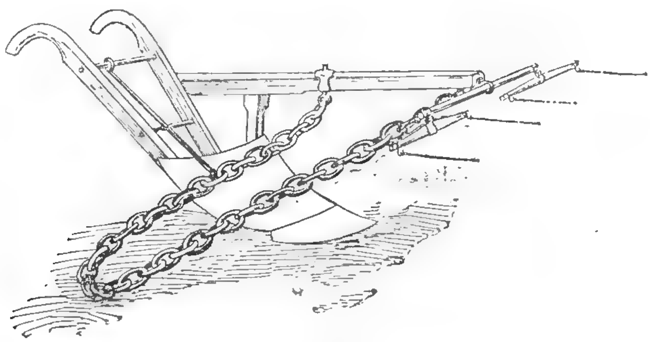
At the end of this period the rations were increased, and were given only four times a day; and again, at the end of a further six weeks' period, a still larger quantity was given, and the number of daily meals was reduced to three. The milk was always given perfectly sweet, and usually mixed with the other food into a mash; the same applies to the whey. The brewers' dried grains were always scalded with a little boiling water, and the potatoes were also boiled. A little phosphate of lime was regularly mixed with the food. The animals were, till the beginning of October, allowed to be in the open for a few hours every day, when the weather permitted, and they were weighed regularly once a week until their slaughter on the 2nd and 3rd December.

The chief conclusions drawn from comparisons of the weights of the animals throughout the whole period, and from the dead weights at the time of slaughter, were as follow:—The feeding with maize had good results. The course of the experiment seemed to show that, by gradually and carefully

accustoming the animals to moderate rations of this feeding stuff, pigs, even of four months old, can be successfully fattened on maize. It would appear also that rather better results were attained with the uncooked maize than with this cereal in a scalded state. As regards the whey, the results were more uncertain, and the point requires further elucidation. The experiment with brewers' grains was also inconclusive, as the weight of the two animals of the fourth pair differed considerably from each other. The fact, however, that the average dead weight of this pair upon slaughter was noticeably lower (proportionately to the live weight) than that of the first and second pairs, would seem to indicate that the brewers' grains were inferior to the maize and skim-milk.

Ploughing-under Green Crops.

In ploughing-in green crops such as clover, peas, and vetches, there requires some little management in doing the work effectively. There is a difficulty in covering up the haulms and stalks completely. To facilitate this operation, a chain is attached to the plough as shown in this illustration (from *The Agricultural Journal* of the Cape of Good Hope):—



The chain (A) attached to the plough is held in its proper position by the rod (B), and this contrivance will be found a great assistance in turning the stuff under and covering it up. The chain should be tolerably heavy. If a suitable rod is not at hand, a pole may be fixed as a makeshift, but if much work has to be done, it will pay to give a job to the blacksmith.

Stacking Hay.

From the *Lynn Advertiser* (King's Lynn, Norfolk) we take the following remarks on stacking hay by W. J. Malden :—

Some few years ago a man disappeared in a singular manner, and the discovery of his whereabouts was of a sensational nature. The occurrence happened near Enfield, in the "hay country." As is not unusual, a man, on the look-out for work in the hay, applied for a job at a place where a hay-stack was in course of being built, and was set to work on the stack. Chance labour attracts little attention in the hay country, but his fellow-workers were surprised he did not turn up, chiefly commenting on the fact that he should have gone off without asking for his day's pay. The circumstance faded from the memory, but it was brought back very vividly during the following winter, for, when trussing out the hay, the man's body was cut into, and his clothes were recognised as those of the man who had disappeared. He had evidently made his bed on the stack, and been overcome by the fumes and gases given off by the fermenting hay. He doubtless sank into the light hay, and, when the stack was laid out again next morning, a fresh lot was thrown over him, so that his presence was not noticed. This incident was related to me by a man named Goodship, who was at work on the stack at the time of the occurrence. It might be taken that the man was smothered by the grass and suffocated in that way, but a hay-stack, when freshly built, always ferments to some extent, and the fermentation is associated with the giving off of carbonic acid gas and volatile hydro-carbons. The carbonic acid gas is well known for its poisonous effect, and the volatile hydro-carbons include among them alcohols. In this case there was no extraordinary fermentation, but sufficient of these carbon compounds were given off to kill the man. This shows that they must be considerable, and the fact is one which bears in no small degree on the condition of hay when put into the stack. Any of these carbon compounds given off originate from the carbo-hydrates, which, where existing in a soluble condition, form a very important portion of the feeding matter in hay. The heating of hay cannot occur without loss of the carbo-hydrates which exist in the form of starch and sugar; one of the main objects of hay-making is to preserve these. If hay is allowed to become over-heated, an undue amount of these is lost, and the hay, is consequently of less value. At the same time a slight fermentation effects a useful purpose in developing the ethereal odours which are associated with the best hay, and which render it more attractive and more palatable to animals; so that it is found in experience advisable to cart the hay before it has become so dry that fermentation cannot ensue. Experience alone can tell what this point is, and according to the amount of leafy herbage, especially of such succulent plants as plantain, dandelion, &c., the extent of drying has to be regulated. This is recognised by most makers, who express it that the grass has "a thick bottom." The present is a season when there is a considerable amount of bottom growth, so we need not be surprised if the next few weeks reveal rather more than the usual quantity of hay-stacks which have got too hot, and have to be turned to prevent firing. Good hay-making is effected specially in the direction of getting rid of the outer moisture; for experience shows that, within limits, mould rarely forms in stacks which heat, because the hay was put together in too green condition if dried outwardly, while, even though the hay be over-made but damp through want of proper handling, the stack is sure to

become mouldy. This is due to the different form of fermentation which is set up, that which is produced by outward moisture being more suitable for fungus growth. It might be thought that moisture in one form would have the same effect as that in another, but it has not. Wet hay is wet from free water, while, in outwardly dry and nearly made hay, the water exists as water in combination, which is given off slowly, inducing the development of ethereal odours. In the case of wet hay there is a large development of the fermentation, causing the formation of acetic acid. Most of those who have made hay for a number of years have learned to distinguish between a natural heat and a water heat, because the former is sweet and the latter sour. It should not be forgotten that a water heat is often caused by the presence of small locks of hay which have not been shaken out properly; and when it is further remembered that the taint from a small piece of mould spreads and contaminates a large portion of a stack, thereby lowering the quality and feeding value, as well as the sale of the stack, it shows how necessary it is to do the work thoroughly.

Smut of Corn.

From a paper read before the Agricultural Discussion Society by Mr. Thomas Winter, M.A., Professor of Agriculture, University College of North Wales, Bangor, the *Mark Lane Express* takes the following on the remedy for smut in barley:—

Jensen found there are two distinct species of smut which affect barley. The species which occurs more frequently destroys the entire ear, including the outer envelopes of the kernels, so that in a week or two the spores are scattered by the wind, leaving the rachis bare. This species is now known as *Ustilago nuda*, "the naked smut." In the other species, *Ustilago Jensenii*, "the covered smut," the outer cases of the kernels are not destroyed, but remain intact for some time; eventually, however, minute fissures appear in them, and through these, some of the spores escape. Of the two, the naked smut occurs more often, but the covered smut is much more injurious if the crop is affected to any considerable extent. The spores of the naked smut are blown away before harvest, so that the injury is confined to the ears attacked; but as the ears affected by the covered smut remain intact and are harvested with the grain, it may cause very serious damage by blackening the bulk of the corn when it is threshed.

Oats do not suffer in the same way as barley, as they are only affected by a loose smut, the effects of which disappear before harvest.

Since 1888 several methods have been tried for the prevention of smut, chiefly on the Continent and in the United States, with varying results. Dressings of sulphate of copper, which have been so successfully used for the prevention of bunt in wheat (*Tilletia tritica*), are much less effective in the case of smut. This is no doubt due to the fact that the spores of bunt are on the outside of the grain, while the smut spores in oats and barley are within the husk, where they are out of reach of the ordinary dressings. Jensen found that dressing seed barley with a 1 per cent. solution of sulphate of copper (1 lb. of sulphate of copper to about 10 gallons of water) did not check the smut to any extent. A 5 per cent. solution of the same substance was more effective, but did not prevent the disease, although it killed a considerable amount of seed. Jensen's results have since been confirmed by Kellermann and Swingle. In 1896 the seed for over 70 acres of the barley previously referred to, in Yorkshire, was dressed by Mr. T. Winter with a preparation which is largely employed in the neighbourhood for dressing wheat, and about one-third of which consists of sulphate of copper, but, so far as could be seen by comparing with a crop grown from the same seed in an untreated state, the disease was not perceptibly diminished. The dressing in this case was equal to a 1 per cent. solution of sulphate of copper. Sir John Thorold appears to have killed the fungus by dressing the seed with tar and paraffin, but Carruthers points out that "this is a somewhat dangerous dressing which, if applied either a little too long or too strong, will kill the seeds of the barley as well as the spores of the smut."

It would appear from the experiments of Jensen and Kellermann that, for dressing oats, a ½ per cent. solution of sulphate of copper (1 lb. to about 20 gallons of water) may be used with success, but, as oats are only attacked by a loose smut, it is not likely that dressing the seed will to any great extent be resorted to

By far the most effective treatment both for barley and oats appears to be obtained by Jensen's hot-water method, which consists in steeping the seed in water heated to a temperature of 130 degrees to 134 degrees F. for five

minutes. Keilermann and Swingle, who have successfully adopted this method, suggest that the steeping process should continue for fifteen minutes. This method not only prevents smut without injuring any of the seed, but is also said to make the corn germinate more evenly, a point of great importance to the growers of high-class malting barleys. Jensen found that while treating with hot water alone at 130 degrees to 134 degrees F. was sufficient to prevent smut in oats, it did not succeed in checking the disease in barley unless the barley had previously been steeped in cold water for six or eight hours. He suggests that the temperature of the hot water for steeping barley should be from 127 degrees to 130 degrees F. To carry out this hot-water method, two large vessels are required—one containing hot water at from 110 degrees to 120 degrees F., the other containing hot water at 127 degrees to 130 degrees F. (130 degrees to 134 degrees F. for oats). The first vessel is for warming the seed before dipping it into the second, so that the temperature of the hot water in the second vessel may not be much reduced. The temperature of the water must be gauged by a thermometer, and must be prevented from falling by pouring in hot water from a boiler. The seed corn is placed in a heavy wire basket lined throughout with fine wire-netting (about twelve meshes to the inch), and so constructed as to allow the water to pass in and out freely on all sides, while preventing the escape of the grain. A sack made of loosely woven material can be used instead of the basket. The basket or sack containing the grain should be dipped into the first vessel, and should be kept moving up and down in the water, so that every grain may be brought in contact with the hot water. After remaining in the first vessel for about a minute, it should be dipped into the hotter water in the second vessel, and moved up and down as before, but in this case the process is continued for from five to fifteen minutes, after which the grain should be cooled with cold water and spread out to dry.

The Jensen hot-water method is the only really effective process yet discovered for preventing smut in barley, but at the same time it will be noticed that it involves a good deal of labour, and it is also important that the water should be kept at the proper temperature. *It is to be hoped that farmers will take every possible precaution to procure seed from a crop free from smut.* This may involve a certain amount of expense, but it will be slight when compared with the loss which will inevitably follow where seed from a diseased crop is sown.

The Velvet Bean as a Fertiliser.

In the August issue of this *Journal* we drew attention to the reported value of the Velvet Bean (*Dolichos multiflores*) as a fodder plant and as a fertiliser. We also stated that the Queensland Department of Agriculture had made application to the Texas department for seeds of the bean. The Louisiana Sugar Experiment Station is distributing the beans in quantities of one pod to each applicant. Time has not yet permitted of the arrival of the bean in Queensland, but meanwhile it may be as well to again draw attention to the merits attributed to it by our American cousins.

Mr. F. H. Boucher, of Orlando, writing to the *Florida Farmer and Fruit Grower*, alludes to its qualities as follows :—

"I am planting my own orange grove in velvet beans, and would like to tell your readers what I have seen that persuaded me to plant. My neighbour made a big crop of beans on a small patch that he uses for potatoes, forage crops, &c. I went over to see the patch late in the fall, and found all the vines, &c., wilted down and lying on the ground. They made a mulch of leaves and vines fully 4 inches deep clear over the patch, and the ground underneath was very mellow and loamy.

"Another neighbour planted 3 pecks of beans in his cornfield, about 2½ acres, when he laid by his corn. He gathered 60 bushels of beans shelled, and they were the finest in this neighbourhood. This year, he has the same land planted in corn again. The plot where the beans were grown looks like river bottom* corn, strong and lusty; where the beans were not planted, though the land is precisely the same in other respects and has the same treatment, the corn is not half so good.

"These beans certainly seem to be the boss for making humus, and gathering the most expensive of fertilisers—ammonia. I would advise everyone to shade their land from the hot sun, and provide fertiliser and humus for future use by planting these beans whenever possible. The crop itself is a valuable one, making splendid forage for horses, cattle, and hogs. Hogs especially fatten and thrive on the beans."

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* Corresponding with our rich riverine scrub lands.—Ed. *Q.A.J.*

The Sweet Potato.

In the first issue of this *Journal* (July, 1897) we published a valuable paper on the above subject by Mr. H. A. Tardent, manager of the Westbrook Experiment Farm. Reference to this paper will show that Mr. Tardent claimed a possible return of 25 tons per acre of 8,000 plants. He had raised as much as 16 tons himself in the Roma district (320 miles west of Brisbane), and grew what he believed to be the record heavy potato, which turned the scale at 29 lb. His paper attracted much attention, and we have heard doubts expressed as to the yield reaching 25 tons per acre. Knowing that sweet potatoes had been most successfully grown at the Penal Establishment of St. Helena by Captain Pennefather, Comptroller of Prisons, and, wishing to place beyond doubt the highest yield ever obtained in the colony, we requested the comptroller to give a few facts for publication in the *Journal*. He kindly forwarded to us replies to questions we submitted, the replies being extracts from the official returns of crops grown on the island. We cannot do better than give the questions we submitted, and the replies appended thereto, as follow:—

H.M. P.E., St. Helena, 10th September, 1897.

Memorandum:

In reply to Major Boyd's list of questions in reference to sweet potatoes grown here, attached to your memo. of the 25th ultimo, I beg to state as follows:—

Major Boyd's Questions.	*Reply.*
1. What area was under cultivation at St. Helena in sweet potatoes, about 1889 or 1890?	About 12 acres; year, 1888.
2. What was the average crop per acre?	Not known.
3. What was the greatest return per acre (saleable potatoes)?	Warder McPherson made it to be 35 tons of saleable potatoes per acre.
3*a*. On how many acres was this large return?	About 6 acres.
4*a*. What was the average price obtained?	4s. 9d. per cwt.
4*b*. What was the highest price?	£6 10s. per ton.
5. How many tons were sold for cash?	155 tons 9 cwt.
6. (*a*) How many tons were used for stock, and (*b*) domestic purposes?	(*a*) Quantity used for stock is not known; (*b*) 38 tons 6 cwt. 2 qr. 4 lb. used for domestic purposes.
7. What was the total net return?	Not known.
8. On what kind of soil were they grown?	Red soil; volcanic.
9. What manure (if any) was used?	None.
10. What kind of a season was it as to rainfall, heat, &c.	Good season; particulars as to rainfall, heat, &c., not known.
11. What variety was planted?	Maltese.
12. What was the weight of the largest potato?	34 lb.
13. At what distance were they planted between the rows?	3 feet.
14. Were they grown on the flat and hilled up, or planted on hills?	Planted on hills.
15. What was done with the vines?	Given to the cattle and pigs.

J. RYAN, Superintendent.

To Deputy Comptroller-General of Prisons, Brisbane.

It will be seen from the above statement furnished to Mr. A. Peirson, Deputy Comptroller of Prisons, that not only was Mr. Tardent's estimate of

yield absolutely correct, but far within the mark, 6 acres of the St. Helena land having produced 210 tons or 35 tons per acre, not taking into consideration the small unsaleable potatoes which were fed to stock and the quantity unavoidably left in the ground after digging.

Captain Pennefather adds:—"The cuttings were planted in low ridges and covered by a specially made plough. After the plough, a man followed, pressing the soil against each cutting with his foot." Although no official record was taken of the rainfall and temperature during the growing season, Captain Pennefather, from private records kept by him, states:—"I must premise that the season was abnormally favourable, and at harvest time the English potato crop was a partial failure, which will account for the excellent price obtained." It will be observed that Mr. Tardent recommended planting on hills for the coast districts, and this is precisely what was done at St. Helena with the above result.

Analysing the report, we find that, roughly, 155½ tons were sold for cash at an average price of 4s. 9d. per cwt., or £4 15s. per ton, giving a return of £738 12s. 6d. for the 12 acres (besides which over 38 tons were used for domestic purposes), or in money value £180 10s., making a total of £919 2s. 6d. But if the produce of the 6 acres alone had been sold at the higher price—viz., £6 10s. per ton—the return may be put at £1,365 for 210 tons. It should be noted that no manure was used on the land, which had been cropped for several years previously with sugar-cane. In addition to the crop of tubers, cattle and swine were fed on the vines for several weeks.

Mr. Tardent will be pleased to know that the champion sweet potato of this crop turned the scale at 34 lb. It will thus be seen that, given a good season and a good red volcanic soil, not too heavy, the sweet potato will yield a return which, at the usual price of 2s. 6d. per cwt., exceeds in money value any other ordinary farm crop, excepting coffee.

Friend or Foe.

A PRELIMINARY INQUIRY.

By HENRY A. TARDENT,
Manager of the Westbrook Experiment Farm.

No doubt the early history of Australia lacks the warlike episodes to be found in older countries; still, when writing about the origin of our Australian Commonwealth, the Carlyles of the future will have to record an abundant harvest of heroic deeds furnished daily by the pacific conquest of the continent. Could there be anything more heroic, indeed, than the travels of our explorers through an unknown and inhospitable continent; the perseverance and endurance of the squatters who followed in their steps; of the farmers who came next, and crowned the conquest by compelling the earth to become fertile and bring forth her fruit?

It has been the privilege of the writer to watch rather closely some of the great wars of this century in Europe. He has also spent many years of his life amongst the Australian farmers; and he has no hesitation in saying that, in his eyes, the redeeming of the wild bush, and the establishment on it of a station or of a farm in working order, entail as much self-denial, courage, perseverance, and real heroism as are to be found associated with the most famous victories.

In former times the farmer used to be left pretty well to himself in his fight against Nature. The Governments of those days thought they had done enough when they had maintained order, collected the taxes, and insured the safety of the frontiers. It is a redeeming feature of our generation that now the Governments of the more advanced countries of the world have a much higher notion of their duties. The powerful means at their disposal are now directed towards helping the farmer to subdue the refractory forces of nature. Here, for instance, in Queensland, in a young community of less than half a million of inhabitants, we have a scientific body watching over the health of the community; a chief inspector of stock constantly on the lookout for anything capable of enhancing the prosperity and well-being of the millions of domestic animals entrusted to his care; a geologist, who advises the miner; a hydraulic engineer, who, like Moses of old, strikes the earth with his rod and causes artesian springs to flow where there was previously only desert and water famine; a meteorologist, who investigates for us the laws of our atmosphere, bringing by his daily forecasts incalculable benefits to the agriculturist—benefits which will still be greater when, in the course of time, he will be enabled to forecast seasons perhaps years in advance; an entomologist, who has most patiently studied our friends and foes of the insect world, and has discovered, amongst other useful things, the very parasite which preys on the fruit fly, and is likely to rid us of this terrible pest; a fruit expert to advise and direct the operations of orchardists; a bacteriologist, who moves with perfect ease amidst our friends and foes of the bacterial world, taming them, concluding alliances with them for our benefit, compelling them to save our cattle from tick fever and our pastures from the depredations of the rabbit, &c.; and last, but not least, we have a botanist, who has spent a long and most useful life in conquering and classifying new plants for our use, and in warning us against the introduction of such plants as might become noxious to us. More recently, other forces have been joined to these; centres of agricultural science have been created, where the accumulated knowledge of humanity will be, so to say, focussed and put within the reach of the growing generations.

The above rather heterogeneous considerations are not heaped here together without some ultimate end in view. Before signalising the presence amongst us of a new enemy, the writer wanted to show that we are fully prepared to meet him. He might inflict on us wounds and losses; still he is doomed as soon as we direct against him the means at our disposal.

But is it really an enemy? That is the question.

It is usually known under the name of "prickly pear." Jussien calls it *Cactus opuntia;* de Candolle, *Nopal*. To the French it is known under the somewhat pompous name of Figuier d'Inde. Medicinally, its fruits are said to be diuretic, whilst the fleshy part of its flat stems (raquettes) is used to mature tumors. Applied on corns, it softens them so that they peel off easily when they are subsequently soaked in hot water. The prickly pear came here with the best of credentials. It is printed—black on white—that some nations —the Mexicans, for instance—rear their cattle on it; that others, the Sicilians, sustain even human life on its fruits. The great "Dictionary of Botany" of Mavut and Decaisne says that it is to the Mediterranean nations what the banana is to the intertropical populations! It is also recommended as forming impenetrable hedges. This last point is the cause of our troubles. As is well known, some people like their neighbours best when they are at a certain distance, and separated from them by substantial fences or hedges. Thus it is that some thirty years ago an inhabitant of Drayton imported some prickly pear plants from the south, and formed with them a hedge round his property. The plant gave entire satisfaction, and became very popular all over the Downs, and far away in the West, everyone wanted a hedge of prickly pears. This latter seems to have found here a most congenial soil and climate. It is easily propagated from roots, from cuttings, and from seeds. The smallest piece of stem left on the ground is sure to take root there. The seeds have also the singular property of passing through the digestive organs of animals without losing their germinative power. Marsupials and birds have thus become the most active agents for its dissemination. It has spread rapidly all over the Downs. Dalby, Jondaryan, and the country on both sides of the Condamine River are already infested. In some places it is so thick that no man or horse can pass through it; not even a snake would venture there, as a bushman said. It has now reached as far West as the Maranoa River, the volcanic soils of the hills and the immense loamy plains proving a most congenial feeding-ground for it. It thrives in wet, and delights in droughts. Should we really find some practical means of utilising it for some payable purposes, it would prove to be an invaluable acquisition, for no plant has as yet showed such a perfect adaptability to our soils and climate.

It has been suggested that we should feed our cattle and pigs on it. For that purpose the plants are passed through a fire which destroys their thorns and hairy stings, or, still better, they are steamed in large boilers mostly made of iron malt-tanks.

It has also been proposed—

To turn the fruits into jams and jellies;

To ferment the fruits, and to distillate from them a sort of brandy;

To utilise the plant for rearing on it the cochineal, and manufacture from it the well-known carmine dye, &c.*

It is not improbable that the whole plant could be turned also into a kind of artificial manure by a process now employed in some of the most advanced cantons of Switzerland, and thus described in the scientific part of the *Bibliothèque Universelle*:—

Take 200 or 300 kilogrammes of weeds; let them wither for a few days under a shed, turning them over occasionally. When an active fermentation

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* The cochineal insect lives on a different species of cactus—the *Cactus cochinellifer*, introduced from Mexico by Thierry de Meronville to the French colony of San Domingo in 1677; and in 1827 by M. Berthelot, director of the Botanical Gardens at Orotava, into the Canary Islands, where it thrives on the *Opuntia ficus indica*. The cochineal insect was placed on the proper plant in the Botanical Gardens some thirty years ago by Mr. W. Hill.—Ed. *Q.A.J.*

has set in and the leaves begin to turn yellow, throw the whole lot into a pit, and pour on it one kilogramme of hydrochloric acid and one kilogramme of sulphuric acid—both of which are quite inexpensive—diluted in, say, 5,000 or 6,000 litres of water. Stir well three or four times a week. In about a month's time the manure is ready for use. It is said to be very beneficial on meadows.

Another process consists in preparing with it so-called nitrated superphosphates. The plants are thrown into sulphuric acid at 60 degrees Beaumé. In less than a day they are dissolved by the acid; the resulting dark-brown liquid is then used to treat phosphates with, which are, under its action, transformed into superphosphates, with a slight proportion—about 2 per cent.—of nitrogen in them. True, this is not much, but it is contended that the ordinary farmyard manure contains only ½ per cent. of nitrogen.

Notwithstanding all the above various uses of the prickly pear, the writer must confess he has great doubts as to its utility to us. He cannot help remarking that the nations which are said to *thrive* on it—the Sicilian and the Mexican—are amongst the poorest in the world. He is much afraid that our economic conditions and the price of labour in these colonies will be insuperable obstacles to its utilisation. He has no analyses at his command as to the feeding value of the plant, but from practical trials with cows and pigs he is inclined to put it very low indeed. The fruit has another disadvantage. It contains a most powerful red colouring dye which permeates the flesh, the bones, and the very marrow of animals fed on it—even poultry—thus depreciating their marketable value.

A few squatters have already abandoned their holdings. Others have set to work and spent considerable sums of money in destroying it. Camps are being formed, the men receiving from 15s. to 20s. per week and found. Where timber is available, large heaps of it are made. The prickly pears are then dug out a couple of inches under ground with long-handled hoes or mattocks, wheeled on to the wood-heaps, and burnt. In other places large trenches are dug in the ground, and the plants are being buried in them. On the Experiment Farm we simply throw them into the holes of stumps and trees dug out for clearing the land, the cost of destroying them being thus reduced to a mere trifle.

The writer, it goes without saying, does not pretend to solve in a short article such a complicated question; but he begs leave to suggest the following simply as hints towards possible solutions and as a sort of basis for discussions and suggestions:—

To test without delay the practicability or otherwise of the above or any other means which might be suggested for utilising the plant. Should none—as he anticipates—turn out satisfactory, then steps should be taken at once to eradicate the pest by every possible means.

In the meantime let all keep their places free from the pest, remembering that in this case the proverbial stitch in time would not save nine, but most likely 9,000,000.

Sugar at Bundaberg.

Continuing our notice in last month's *Journal* of sugar operations at Bingera, we now present a description of the sugar house and mill on the Messrs. Gibson's plantation.

The Mill Buildings are two stories high, and are 40 feet high to the wall-plates and cover nearly an acre of land, but the mill and yard, with the various buildings, men's dwellings, offices, stores, sheds, stables, &c., cover fully 10 acres of ground, the whole being intersected with tram lines. Taking the internal fittings in their natural order, we commence with the " carrier," which is a travelling elevator into which the cane is dropped from the railway wagons and small plantation trucks; the latter are run over the carrier and tilted direct on to it, the former are emptied into a hopper and gravitate to the carrier in a regulated feed. This elevator is 5 feet wide and 135 feet long, conveying the cane upwards to the shredder. The shredder may be said to be a number of large-ribbed discs fixed on two shafts, each shaft running the reverse way to the other, through which the cane passes and is thus torn to shreds; the cane then falls into the first set of rollers. By this means the mill will crush from 10 to 15 per cent. more cane and will also increase the extraction of juice, as a more even feed is supplied, also avoiding an uneven strain on the roller shafts and bearings.

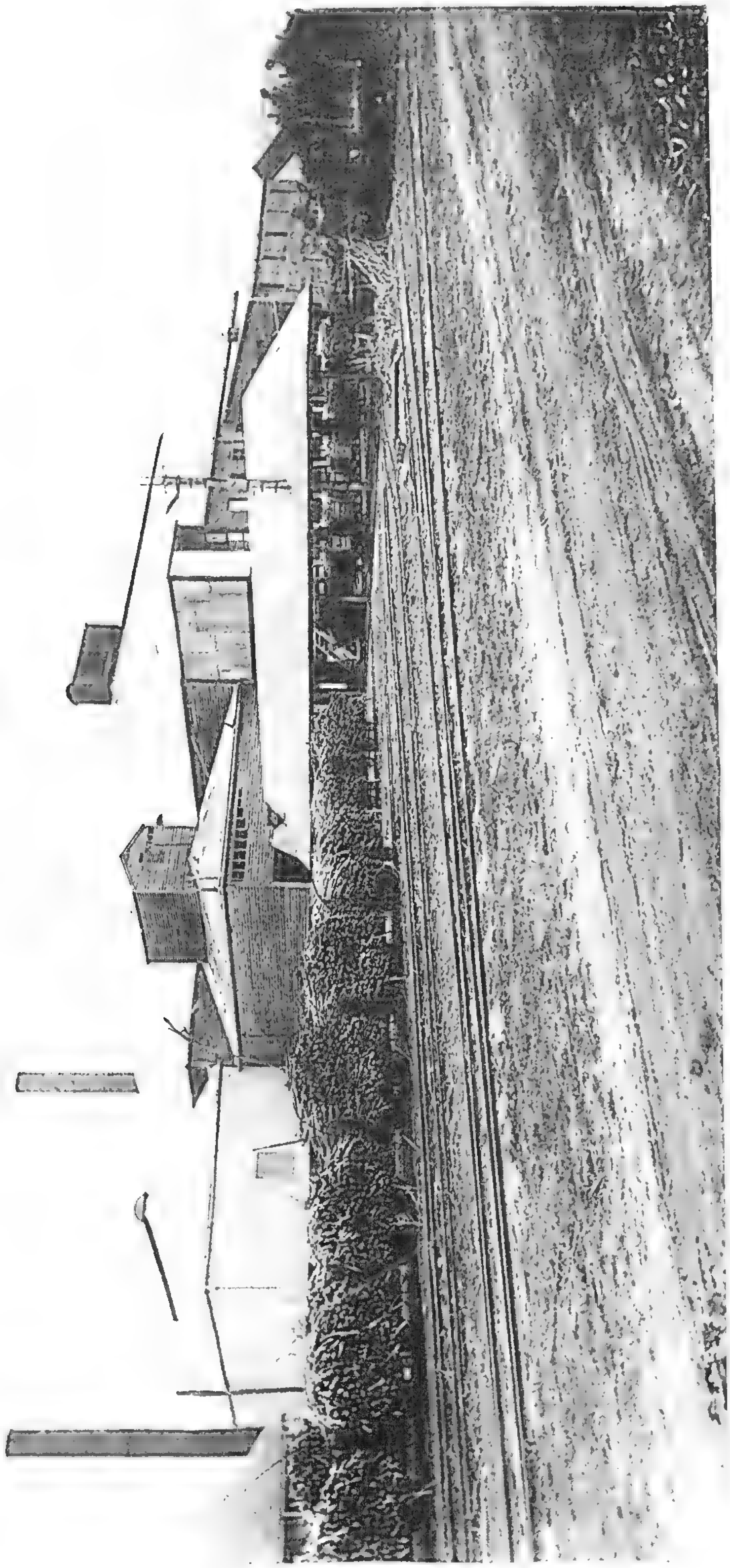
The Rollers.—There are three sets. The first two sets are 30 inches by 60 inches; the third set, just supplied by Walkers Limited, is 34 inches by 66 inches, with 17-inch shafts. This set of rollers is about the largest in the colony, and able to crush 25 tons of cane per hour. Each set of rollers has a separate engine with large fly-wheels and heavy gearing. To give an idea of the weight of a set of rollers, engine, gear, and beds, that supplied by Walkers Limited weighed 127 tons. From the rollers the megasse is carried by an elevator to the automatic feeder, which was made and supplied by the Bundaberg Foundry, and is a new contrivance for giving the boiler furnaces an equal feed. A feeder is attached to each furnace, in the form of grooved rollers which revolve at a fixed speed and will only receive a given quantity of megasse. Where one man formerly was required at each furnace, by this apparatus one man attends to the whole system.

The boilers are eight in number, and of the multitubular type, and give steam for twenty engines and pumps. The whole of the juice is also evaporated by steam. The process of evaporation commences with the triple effêts, of which there are two sets of 4,000 and 6,500 feet heating surface; the larger set this season being equal to the juice supply, or 100,000 gallons in the double shift, or, say, twenty hours' work of the mills. The juice passes from the triple effêts to subsiding tanks, from which the vacuum pans (three in number) receive their supply. Only two of these have been required this season, and have given each a strike of 8 and 10 tons white sugar, of a hard granulated character, which is dried in centrifugals—of these there are twelve of the "Weston" type. An elevator is running continuously under the centrifugals, into which the dried sugar is dropped. The elevator then carries it to the patent dryer, a large revolving cylinder, 5 feet by 24 feet, through which the sugar passes over a low steam cylinder; by this means all the moisture is removed from the crystals, and the sugar is ready for bagging. We might mention that last week's sugar returns were 286 tons for the one week. All the skimmings from the clarifiers and the sediment and dirty juice from the bottoms of subsiders are passed through six filter presses, and the residue is then filter cake, which is suitable for manure purposes.

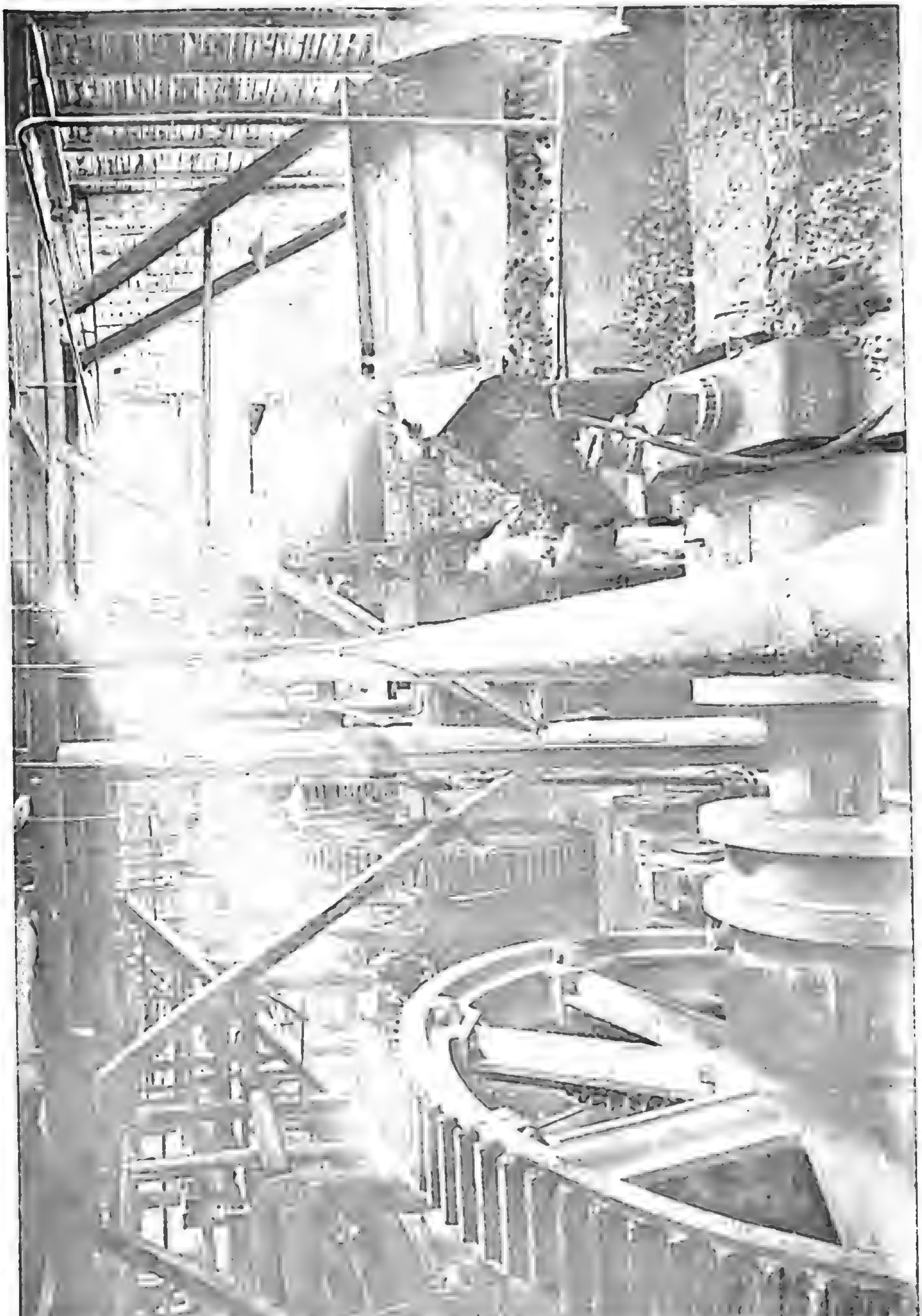
The bags are made at the mill: two young people are engaged measuring out, cutting, and sewing the bags, about 1,700 being made up daily.

Refrigerator.—40 feet wide, 75 feet long, and 51 feet high, with ten shelves, on which are placed small bushes. This is one of the many means employed to reduce the cost of manufacturing sugar. Bingera requires about 60,000 gallons of water per hour for vacuum purposes. In the past, this water has been lifted by powerful pumps, erected in the bed of the Burnett River, 200 feet (vertical) below the mill level; but, by placing a pump alongside the refrigerator, all water and condensation of the cane juices are arrested and thrown on top of the refrigerator, which is so arranged that an even supply of water is allowed to pass over the whole surface and then down through the bushes on the shelves into a large tank which holds 30,000 gallons of water. The water as it reaches the pump is at a temperature of 145 degrees; after passing through the refrigerator the temperature is 70 degrees. By this means the water can be used over and over again for weeks, thus giving a saving on the river water of 75 per cent. The water from the supply tank gravitates to the vacuum supply tanks in the mill.

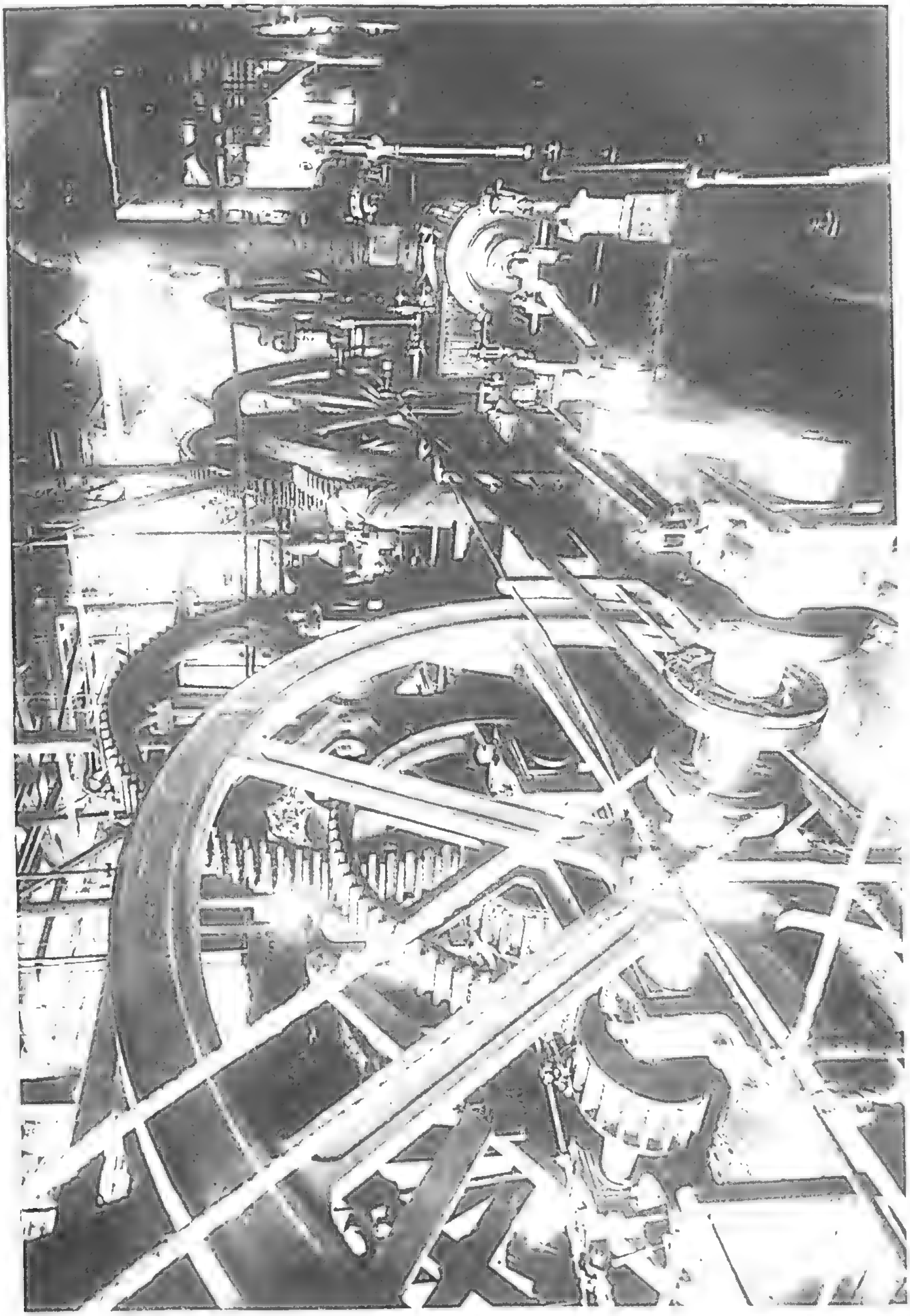
All the machinery mentioned is kept in excellent order, and anything but a minor accident is of very rare occurrence. The arrangements are such that it will be seen at once by the description how labour-saving appliances are utilised, especially in the feeding of cane to the mill and of megasse to the furnaces. The illustrations are from photographs taken in the sugar-house by Mr. F. C. Wills, artist to the Department of Agriculture, to whom the proprietors of Bingera courteously afforded every facility for his work, even to stopping the mill for a few moments.



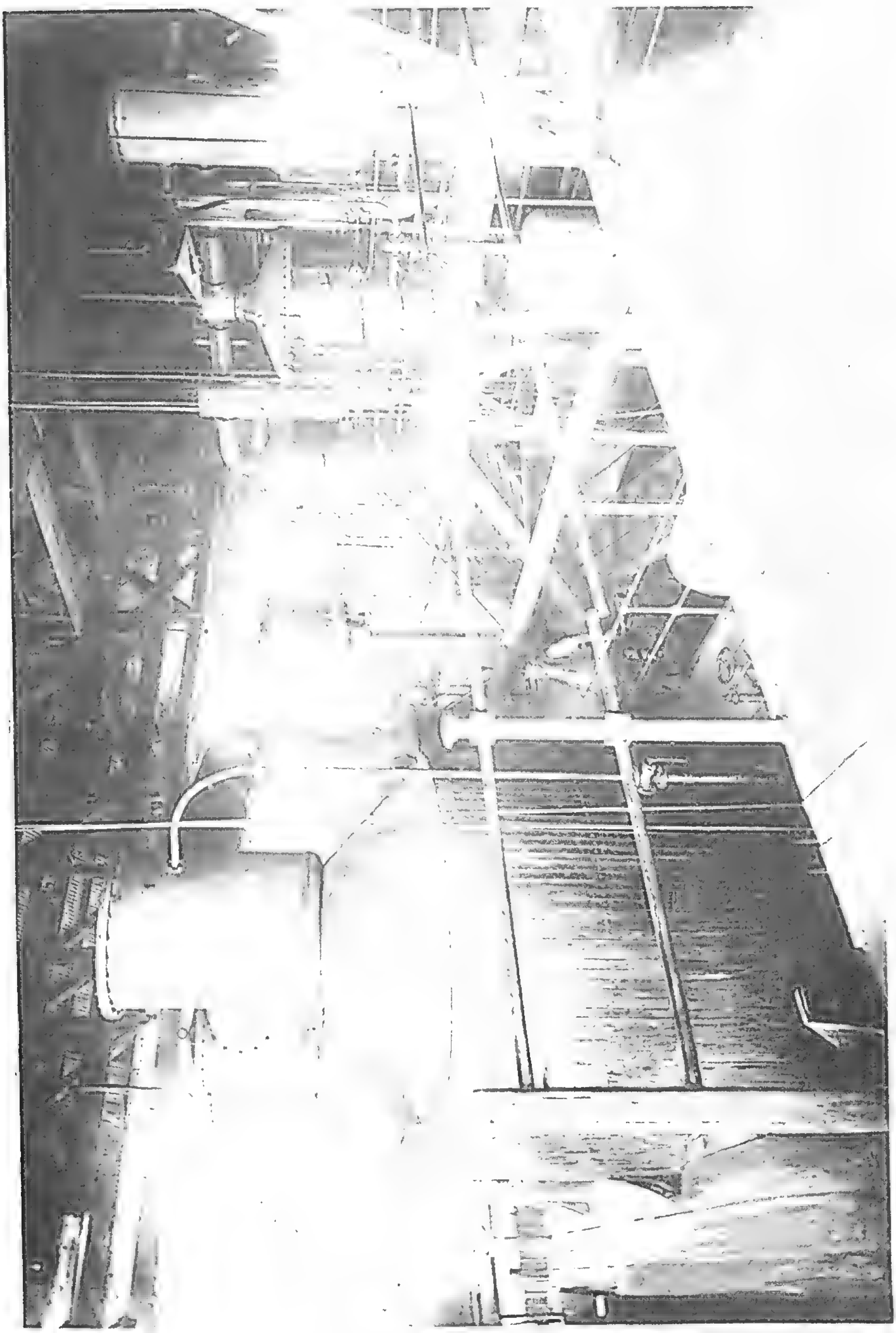
BINGERA SUGAR HOUSE



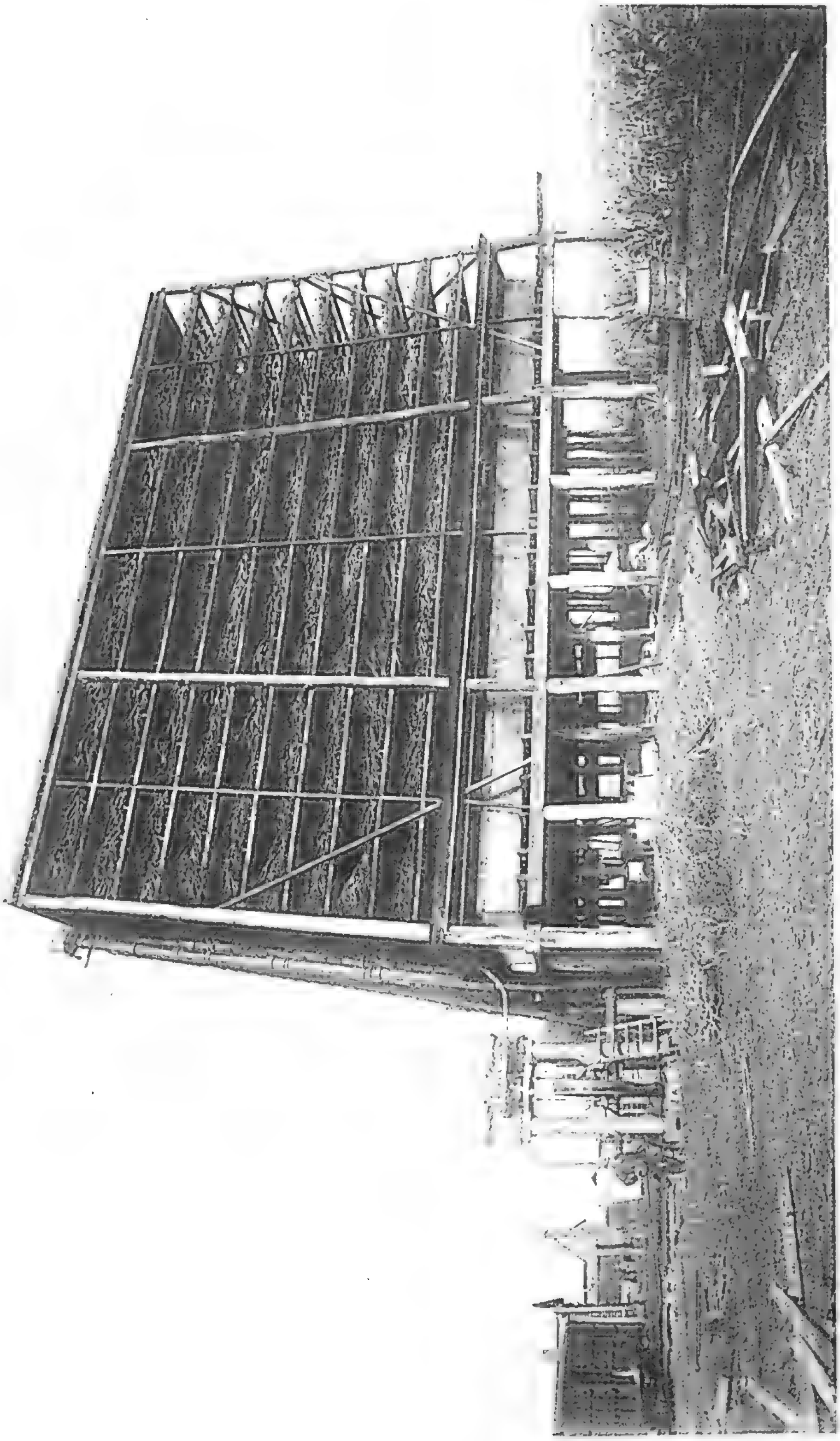
THE ROLLERS—BINGERA SUGAR MILL.



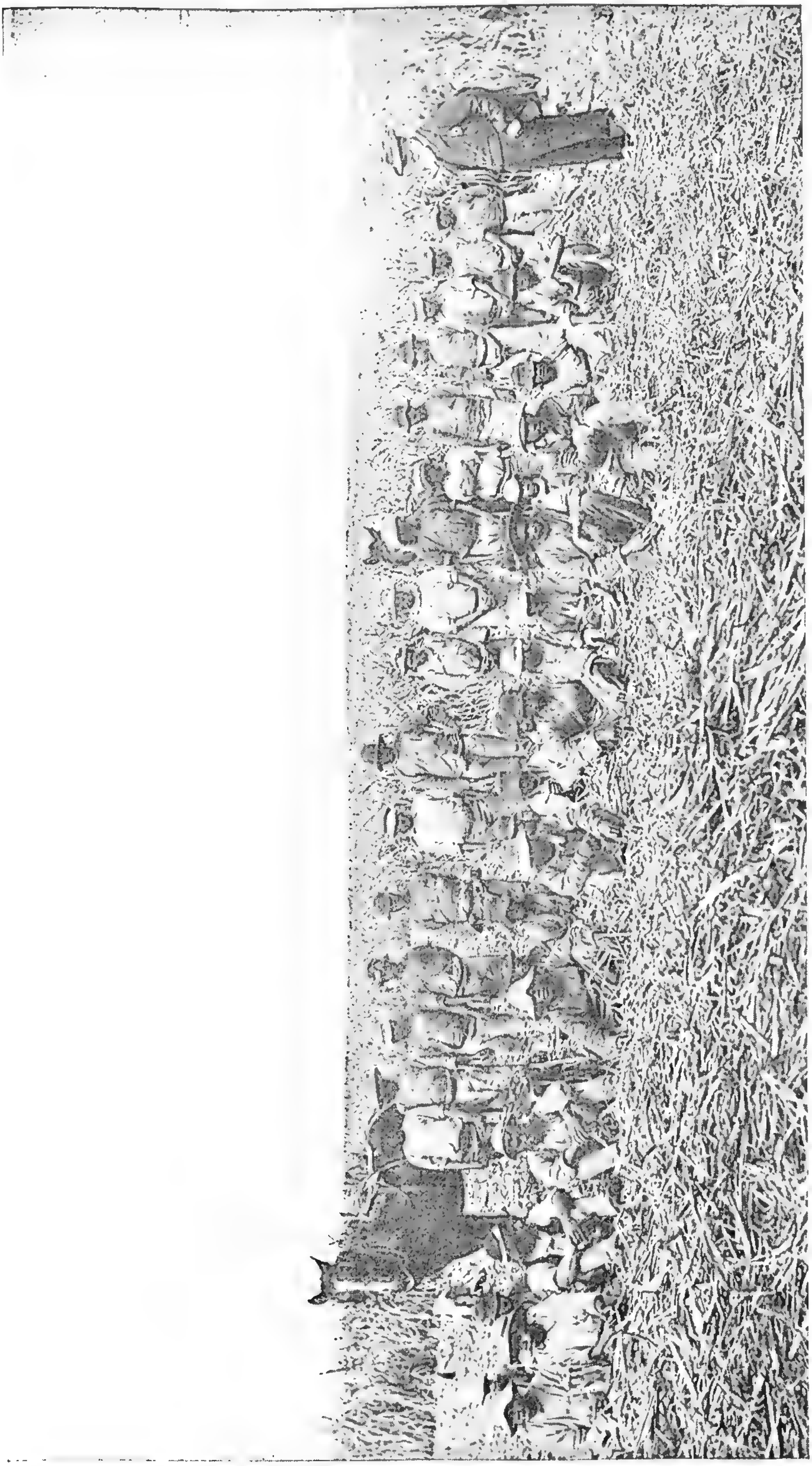
ENGINE ROOM, SUGAR HOUSE, BINGERA.



TRIFLE EFFÊTS, BINGERA SUGAR MILLS.



REFRIGERATOR, BINGERA.



GROUP OF KANAKAS, WATAWA PLANTATION.

Feeding and Treatment of Dairy Cattle.

By JOHN MAHON,
Government Dairy Expert.

We are only too well aware of the fact that in this colony, as is the case in all the Australian colonies, we have dry seasons periodically, and during a period of the year the natural pasturage is unreliable, and in consequence the cows go off their milk and become reduced to such a low state of poverty that, when the next season comes on, the animal, instead of producing milk, requires all the food given her to build up her weak constitution, and is unprofitable to the dairyman.

A little knowledge in feeding and a small amount of extra labour would be the means of placing thousands of pounds that are now being lost in the pockets of the Australian dairymen every year.

There can be but one opinion as regards the urgent necessity of adopting better methods of feeding, sheltering, and treatment of our dairy herds, and it behoves every person engaged in the business to give special attention to these matters. The slipshod system of allowing the animal to provide for herself has passed long ago. It must be apparent to all observant persons that our dairymen have not yet risen to the fact that success in dairying is dependent on the breeding, feeding, and treatment of dairy cattle. We can no longer afford to waste food and labour on cows that will yield only a few pints of milk daily. The yield of milk per cow is of the greatest importance to dairymen, and until raised to a higher standard we may expect to hear of unprofitable results from those engaged in the business. The most essential point, and one which demands the immediate attention of all dairymen in this colony, is to reduce the cost of milk production, which must be done to place ourselves on equal footing with dairymen in other parts of the globe.

The object of every dairyman should be to obtain a maximum flow of milk at the lowest cost. A "Babcock" milk-tester should be kept in use, and the animal that will not pay for her food and labour in milking should be no longer kept in the herd. By judicious culling, carried out by the aid of the "Babcock" tester, the standard of our herds could be raised very considerably. Too much stress cannot be laid on the necessity of testing each cow. Feeding inferior cattle is ruinous.

It is to be regretted that we have no authentic statistics showing the yield of the Queensland dairy herds. However, from personal observation, I am convinced that the yield per cow is very low, and that I am within the mark in placing the yearly average per cow at 180 gallons of milk. In Canada, the annual yield is 340 gallons per cow; New Zealand, 330 gallons; Victoria, 291 gallons; and New South Wales, 274 gallons.

In Queensland last year, 6,164,240 lb. of butter were made, and this, taking an average of 2½ gallons of milk to 1 lb. of butter, means 15,410,600 gallons of milk to produce the above quantity of butter. The average price paid for milk last year was about 2½d. per gallon, which brings the total value of milk converted into butter up to £160,527 1s. 8d. Now taking the average yield of our herds at 180 gallons of milk for the season, means 85,614 cows to produce £160,527 1s. 8d. worth of milk, or an average of £1 17s. 6d. per head. In Canada, the average yield per cow is £3 10s. 10d., being the price of milk at 2½d. per gallon, or £1 13s. 4d. more than the Queensland cows. These figures go to show that the same number of cows—viz., 85,614—in Canada produce £142,681 worth more milk in the season than an equal number in Queensland.

I may state that the Canadians consider their standard very low, and are endeavouring to raise it every year.

The above figures may be taken as very nearly accurate, and go to show the great amount of money that is being lost annually in this colony, exclusive of the waste of food and labour.

The question is very often asked: Does it pay to grow feed for dairy cattle? To which I reply with the only answer: Yes; if the feeding be carried out with skill and judgment, and no animals be kept in the herd but such as will pay for the food consumed—a poor animal will quickly eat her head off. The comfort of the cow in the way of shelter must receive attention, otherwise feeding will show but very poor results.

The power of yielding large quantities of milk is not altogether a natural characteristic of the animal, but has been developed through influence of treatment, which is connected with hereditary qualities and, in a variable degree, is an individual quality. It is folly to expect an inferior animal to respond in proportion to the amount of food she consumes; it is also unreasonable to expect a good animal to develop her full milking capacity from poor feeding.

I feel sure that 90 per cent. of farmers at the present day would feel hurt if told how to feed their herds to enable them to obtain full results, but I yet think that a little advice in this direction would benefit many; at the same time I do not suppose for a moment that the farmer lacks sufficient intelligence to feed his animals, but I say that when feeding is carried out indiscriminately a great deal of waste is the result, and in some cases the health and constitution of the animal are impaired.

Food should be given until the full milking capacity of the animal is attained, which can be done by increasing the quantity gradually until the cow has reached her highest standard.

Feeding should be done regularly, and always after milking. No more food should be given than the animal will consume. If this rule be not strictly adhered to, there will be a considerable waste. It is a mistake to throw food into the yard or paddock where cattle trample over it and waste as much as they eat.

If feeding on concentrated food, it should be steamed, which process makes it more digestible. Concentrated foods are not equal to succulent foods for milk production, although all foods should contain a certain percentage of dry matter. In nearly all food there are to be found nitrogenous compounds or albumenoids; other foods contain nitrogen, such as starch and sugar, but, so far as their value as a food is concerned, they are both the same, and contain that substance which is termed "carbon." The next substance is fat, which is found in all foods, and particularly in seeds. Chemical analysis shows that this oil contains a large percentage of carbon, and performs the same function in the animal as starch and sugar do. These compounds are heat-producing substances, of which sufficient should be supplied to maintain the heat of the body, and are not only necessary to maintain life, but also for the production of butter fat.

Some people may imagine that the production of fat is similar to the production of milk, because milk contains fat, which is not the case. The fat inside the animal is the production of fat only; the production of *butter fat* in the milk is the production of other compounds which is greater than the actual fat in the milk. There is as much casein in ordinary milk as butter fat; therefore, unless the animal be fed to produce casein as well as butter fat, she will not produce milk. F. J. Lloyd, E.C.S., in delivering a lecture on dairying in the west of England, stated that in the formation of fat in a fattening animal there is no formation of casein; the two things, fat production and milk production, are therefore distinctly different.

There is a great deal of waste product on the farm every year that could be profitably utilised if a little care and attention were bestowed in conserving it for a time of need.

There are so many varieties of fodder that can be grown cheaply in this colony that it is needless for me to enumerate them.

The foods that are most suitable to the soil—that will give the greatest return at the lowest cost—are the ones which I would advise the farmers to produce.

During the last few years ensilage has gained great favour as a cheap milk-producing fodder; but, with all its popularity, very little has been done in the way of conserving this valuable food, but I hope to see it taking a leading place among the various fodders within the next few years.

When green fodder is obtainable there is no need for ensilage, but unfortunately we cannot grow it all the year round, but, when it can be grown, it should be conserved in the form of ensilage for a time of need.

The standard ration for a cow depends to a great extent on the percentage of protein matter. The following is considered a good daily ration for an ordinary-sized cow:—20 lb. dry matter, 2·5 albumenoids, 14·5 carbohydrates, 0·50 fat. If feeding with ensilage: 44 lb. daily; lucerne hay, 30 lb.; oaten hay, 30 lb.; green maize, Cape barley, rye, wheat, &c., 70 lb.

The following is an extract from Bulletin No. 97, published by the New York Agricultural Experimental Station:—

"At the prices of foods assumed, there has always been a cheaper supply of nutriment in the green fodder or in the silage than in the grain. The grain usually supplies a larger proportion of protein, and, when the amount of this important constituent is lacking in the coarse food, helps to adjust the ration to the supposedly proper balance. Alfalfa or oat-and-pea fodder contains, however, as large a proportion of nitrogenous matter as do ordinary grain mixtures. Equal nutriment is, of course, always supplied in smaller bulk by grain than by the coarse foods, and is of necessity used to furnish the amount of digestible matter needed without increasing the bulk of the ration beyond what has been considered the proper limit. While a standard ration containing much grain may be suited to bring out the greatest production from the animal, it may under the same circumstances be much more profitable to feed a bulkier ration or a less concentrated ration of equal bulk, even with the assurance of a slightly diminished product. Owing to the ordinarily much cheaper supply of nutriment in the green fodders, it is important to consider any information which may help us to determine the relative amounts of grain and coarse foods that can be fed to best advantage under different conditions. The local conditions are so varying that careful consideration must be given to all data concerning foods. The economical feeder, by studying the records of all feeding trials, will obtain information of much more value than any he can get by simply reading over the summaries of average results. It is important to know what standard rations may be calculated to bring out the greatest product at the greatest average profit, but it is equally or more important to know what modifications of the general rule can be best made for individual conditions. Summaries and generalisations may outline the way, but a study of all available facts is necessary for the special knowledge essential to success."

Some years ago, Victorian dairymen fed very largely on molasses mixed with straw chaff, the results from which were excellent. I would certainly advise our farmers to give it a trial.

The following is an extract from a report sent to the Marquis of Salisbury from H.B.M. Consul Powell in Germany:—

"The following are the advantages stated by experimenters to accrue from the use of 'molasses-mull-fodder':—

(1) It is 50 per cent. cheaper than the best fat-producing food, and yet equal in nourishment.

(2) It tends to keep the animal in health, helps the digestion, and whets the appetite.

(3) It is almost equal in nourishment to and is a good substitute for bran.

(4) It prevents colic and other sickness.
(5) It gives a glossy, healthy appearance to the skin.
(6) In consequence of the large proportion of sugar it contains, it acts as a stimulant, and increases the working capabilities and stamina.
(7) With proper and careful use for milk cows, it increases the production of milk while improving the quality.
(8) When used for fattening it increases weight and improves the flavour of the meat.
(9) It lessens the expenses of the farmer both in respect to fodder and as a manure, the large proportion of alkali in the molasses being especially advantageous in the latter.
(10) It will keep stored for an unlimited time."

Salt for Milch Cows.—A sufficient supply of salt should be given to milch cows. The best plan is to place the salt under cover from the weather, and where the cattle can get at it freely. By so doing, the animal will take only sufficient for her requirements. Salt is essential in the building up of the animal, as it facilitates the passage of the albumenoids of the food. Cows allowed to go without salt on the farm for four or five days, will fall off from 2 to 3 per cent. in quantity of milk.

Milking Competition.

Competition for College Ayrshire bull, "Bruce of Glencairn," presented by the Department of Agriculture to the owner of the cow yielding the greatest average of butter during competition.

WEST MORETON DISTRICT.
FARMERS' CLUB—ROSEWOOD.
SEPTEMBER 7TH, 8TH, and 9TH, 1897.

Cows competing: Property of Mr. Elder, Rosewood.

Date.	Name of Cow.	Milking.	Pounds Milk.	Percentage Butter Fat.	Commercial Butter.	Average for Day.
1897.					Lb.	Lb.
7 Sept.	Lou	Morning ...	25	3·3	0·92	1·79—Lou
	Raatz ...	„ ...	21½	5·0	1·204	
	Lark ...	„ ...	16	3·3	0·59	1·90—Raatz
	Lou	Evening ...	15	5·2	0·87	
	Raatz ...	„ ...	12½	5·6	0·698	0·94—Lark
	Lark ...	„ ...	7½	4·2	0·352	
						4·63
8 Sept.	Lou	Morning ...	24½	3·6	0·98	1·98—Lou
	Lark ...	„ ...	23½	6·2	1·62	
	Raatz ...	„ ...	22½	4·4	1·10	2·33—Lark
	Lou	Evening ...	16	5·6	1·00	
	Lark ...	„ ...	10	6·4	0·71	1·85—Raatz
	Raatz ...	„ ...	13½	5·0	0·75	
						6·16
9 Sept.	Lou	Morning ...	26	3·4	0·99	1·82—Lou
	Lark ...	„ ...	18	4·5	0·907	1·56—Lark
	Raatz ...	„ ...	21½	3·5	0·842	
	Lou	Evening ...	15½	4·8	0·83	1·62—Raatz
	Lark ...	„ ...	11	4·6	0·56	
	Raatz ...	„ ...	15	4·7	0·78	5·00

Cows competing: Property of J. L. Fredericks, Marburg.

Date.	Name of Cow.	Milking.	Pounds Milk.	Percentage Butter Fat.	Commercial Butter.	Average for Day.
1897.					Lb.	Lb.
7 Sept.	Randy ...	Morning ...	15	3·5	0·588	1·06—Randy
	Brindle ...	„ ...	12	4·0	0·53	
	Butterfly ...	„ ...	18	4·2	0·846	0·88—Brindle
	Randy ...	Evening ...	9	4·8	0·48	
	Brindle ...	„ ...	6½	4·6	0·358	1·71—Butterfly
	Butterfly ...	„ ...	13	6·0	0·87	
						3·65
8 Sept.	Butterfly ...	Morning ...	21½	3·6	0·86	1·60—Butterfly
	Brindle ...	„ ...	14½	3·2	0·51	
	Randy ...	„ ...	16½	3·4	0·67	0·90—Brindle
	Butterfly ...	Evening ...	14½	4·6	0·74	
	Brindle ...	„ ...	8	4·4	0·39	1·30—Randy
	Randy ...	„ ...	10½	5·4	0·63	
						2·80
9 Sept.	Butterfly ...	Morning ...	23	3·4	0·87	1·61—Butterfly
	Brindle ...	„ ...	13½	3·8	0·54	
	Randy ...	„ ...	18	3·2	0·64	0·91—Brindle
	Butterfly ...	Evening ...	15	4·6	0·747	
	Brindle ...	„ ...	8	4·2	0·378	1·11—Randy
	Randy ...	„ ...	10½	4·0	0·470	
						3·63

The results of other competitions are not yet to hand.

Danish Dairying.

The *Mark Lane Express* gives the following description of a Danish dairy farm on the island of Fünen. The estate is the property of Count Bendt Wedell, one of the presidents of the Royal Agricultural Society of Denmark, and was visited by some 200 members of the British Dairy Farmers' Association, in order to see if they could learn something as to the method by which Denmark and Sweden make butter-making pay at its present low price :—

The first surprise was encountered on the Dutch railway (the party having travelled *viâ* Harwich and the Hook of Holland). The dairymen were struck by the enormous number of cattle in the fields ; indeed, so thick on the ground were they that an explanation could be found in it of the relatively large production of butter in that country. In meadow after meadow, with great frequency, were herds of from fifty to 100 of the Dutch black and white cows, a breed which gives a large quantity of milk, though lower in butterfat. There were, of course, many smaller herds, but dairying is a most pronounced industry. It might be added, too, that the hay harvest was in progress, and the yield of grass exceedingly heavy, which will be of great benefit to the farmers, who with their numerous stock must require all they can possibly get. Neatness and tidiness of the cottages and fields and absence of waste were unmistakably to be noticed and admired, and appeared to account to some extent for the lower profits that they manage to live upon. There had been very little damage done to the crops by the recent storms, the injury being confined to the knocking down of rye. This crop is almost ready to cut, and wheat, barley, and oats are fast coming on, although, generally, they will be some time before they are ready for reaping. During the whole of the railway journey through Holland, not one mowing-machine was observed in use, all the labour being done with the scythe.

On arrival on Danish soil, the party at once proceeded to inspect the establishment of Count Wedell, who gave them a hearty welcome.

The dairy is, like the farm buildings, in the latest and best style. They form four sides of a huge square: the dairy on one side, the offices, &c., on another, cowhouses on the third, and horses on the fourth. Behind one block is an immense barn, said to be one of the largest in the world. The dairy, though fitted up in the best method, can scarcely be called a "show" place, as is the case with some of our important dairies in Great Britain. It is intended for work, and the work is done. The Alpha Laval separator is used to extract the cream from the milk of 190 milking cows, and turn it into butter, which is sent to a centre for despatch to England. The cows are of the red Danish milking breed; they have fine skins and hair, and possess several of the characteristics of the Channel Islands breed, but they have small and irregular udders, which do not suggest an annual average yield of from 5,000 lb. to 6,000 lb. of milk per cow. The milk gives off 3½ per cent. of butterfat.

The method of making butter is as nearly mechanical as possible, and what labour is performed is done by women, there being only one man in the whole of it, and he attends to the engine and machines. When the milk is brought into the dairy from the cowhouse, it is pasteurised, then cooled down and separated, and the cream put to ripen, a pure "starter" or ferment being used. The skim milk is given to the calves as is necessary, or made into cheese. The butter is churned in an ordinary Danish churn containing dashers, and is put to drain on a rough table such as is used in some parts of France. Salt is added to the extent of 1½ per cent. when the butter is worked, the working being done on a circular rotatory table. The butter is taken, when finished, to

a cold but dry room, where it is kept pending removal to market. In the dairy a record is kept of the work, the quality of the milk, the quantity, and other particulars relating to the supply. No milk is purchased for butter-making, all being raised on the farm. The milking is done by women, and each milks twenty cows twice a day, besides working in the dairy. The wages range from six to ten guineas per year, and all live in a house set apart for the purpose, except such as are married. At the present moment, butter made at Wedellsborg is sold at 82 öre per lb., or about 9d. in English money. The driving machinery consists of two engines, a 6 and a 20 horse power, and there are two Cornish boilers. This power drives machinery in the cow and other stables, the connection being a long wire which passes over a lake in the middle of the great square. Everything was clean and in thorough working order; one thing that struck the visitors was that the inside of the cheese vat was painted—rather a worse than needless process.

A description of how this farm is carried on will be of interest, because it is remunerative. To a question put to Mr. Boghill, who acted as cicerone, "Does this farm and dairy pay?" he replied, emphatically, "Yes, it is intended to pay, and does pay, though the cost on the buildings has been so very heavy."

The total area of Count Wedell's farm is 940 acres, 120 being permanent and meadow grass land, and the remainder under all kinds of crops, fallows and grass. The rotation is—1, wheat; 2, wheat or rye, manured with 16 tons of stable manure; 3, barley; 4, half mangold-wurzel and half peas, vetches, &c., the whole field being manured with 13 tons of stable manure, the beets having 18 per cent. superphosphate and 175 lb. of nitrate of soda per acre; 5, oats; 6, 7, and 8, clover or grass; 9, oats and barley mixed. The permanent meadows are manured with liquid manure and superphosphate. Average crops are 41·6 bushels per acre of wheat, rye, barley, and oats; mangolds, 36 to 40 tons; hay, 2 to 3 tons. Mangolds are sown on the flat at a distance of 20 inches between the rows. The work on the land is well and effectively done, and there is a wonderful absence of weeds.

It has been already stated that there are 190 milking cows; in addition to these, there are 110 cattle and bulls. The average weight of a full-grown beast is from 1,050 lb. to 1,100 lb. The milking cattle are fed according to their respective powers of yielding, and the fodder consists of mixed oats and barley, oil-cakes, beans, mangolds, and hay. The calves are kept on sweet milk until they are three weeks old, then gradually accustomed to skim milk until they are four weeks old, and after that period until they are five months old they have skimmed milk, together with as much mangold and hay as they will eat. They are bred usually in the autumn, so that they pass from the milk food straight to the grazing time. The first summer the calves graze loose on the permanent grass lands, and receive in addition from 1 lb. to 2 lb. of bran, cakes, or corn (called "strong food"). During the second winter they receive 1 lb. to 2 lb. strong food, and 20 lb. to 30 lb. of mangold and hay daily. In the second summer the heifers graze on the meadows by the sea, but do not receive any strong food. The heifers calve at two years old, in the autumn, and have then cost about £9 or £10 per head.

On this farm there was an object-lesson on the tuberculin test. All the stock is inoculated with tuberculin, and then those which show the reaction, which indicates the presence of tuberculosis, are removed to another place, and are attended to by a separate staff. Thus the healthy and unhealthy are kept quite apart, and the healthy animals have to submit to the test twice a year. If there is the slightest symptom of tuberculosis, the animal takes its place with the others which are in the same state. These affected cows, if good ones, are bred from, and the calf is taken away from its dam immediately after birth and brought up on sterilised milk. It is found that the calves seldom have the disease at birth. Mr. Boghill was asked whether he believed in the tuberculin test, and he pointed to the cattle, and said they showed what

was thought of it. "It is," he added, "not a matter of belief, we know it is the right thing." Here is an instance where the tuberculin test is put to practical use, and it is worth more than all the doubting hints which some of our breeders throw out because they do not want the trouble to carry it out.

Of course, pigs find an important place in the dairy farm, as they consume the milk which is not required by the calves. The breed is a cross between the English white and the Danish native, the former being from Mr. Saunders Spencer's, of Holywell Manor, Hunts. There are kept two dozen sows, and they range in a fenced wood, except just at the time of farrowing, when they are taken into the house. The latter is a fine, large building, very airy, and outside there is a good-sized yard for each sow. There are means, when it is necessary, to warm some of the styes. All the pigs are bred on the farm, and they number about 300 a year, and are sent to the slaughter-houses when they weigh from nine to ten score. The young pigs remain with the sows until they are about four or five weeks old, and are then taken away and fed with milk and barley until they are two months old. After this they are fed with rye and maize until they reach six score, when the maize is changed for barley or molasses, and an addition is made of whey, mangolds, and potatoes.

The horse stock consists of twenty-five for working purposes, ten of them being brood mares. The colts are sold at an age of between one and a-half and three years old, and they are of the Jydske breed, which belongs to Jutland. They are comparatively light horses for farm work, but the wagons, &c., are differently constructed and loaded to English, and consequently are equal to the calls upon them. Count Wedell has many carriage and riding horses, a pair of Swedish cream-coloured ponies attracting great attention. All the horses have undocked and long swish tails, the disfiguring process of docking not having yet been adopted.

THE COPENHAGEN MILK SUPPLY.

As to what private initiative has succeeded in accomplishing in so difficult a matter as the delivery of milk in large quantities and of excellent quality, the Copenhagen Milk Supply Company is a splendid example:—Established in 1878 by a private company under the leadership of Mr. G. Busck, it has now reached a sale of about 2,000,000 gallons of milk and cream. Very few people have any idea of the work which had to be executed before excellent milk could be delivered—work which is performed daily with the utmost conscientiousness. The first thing necessary was to find farms, the trustworthiness of whose owners gave a guarantee that the very stringent regulations drawn up by the company for the feeding of the cows would be scrupulously adhered to. The farms are subjected fortnightly to careful veterinary inspection. The veterinary surgeon fills up a schedule containing particulars about both the cowhouse and the animals, especially if any of the latter are attacked with tubercolosis or other disease—also how much milk the sick cows give, and what is done with it. For the sake of greater security, an inspector is sent round to investigate all the arrangements upon the farms, the condition of the cows, the quality of the hay and straw, whether the rules as to feeding are observed, how far the necessary cleanliness is maintained, what is the amount of ice kept in stock, &c. Besides this, a dairymaid is sent regularly to the farms to enforce cleanliness—more particularly during milking—and to superintend the cooling of the milk; for, in order that the milk may keep during its conveyance to the company's central establishment at Frederiksberg, it is necessary that it should be cooled down to 5 degrees Celsius before leaving the various farms. Recognising the great value of tuberculin in fighting against tuberculosis, and wishing in this way to diminish as much as possible the ultimate danger of infection conveyed through milk, the company, after consultation with Professor Bang, decided that the contractors to the company must have all calves intended for rearing inoculated with tuberculin. If an infectious disease breaks out upon a farm or in the house of a person who assists in looking after the cows, the case must be reported at once. The milk will then be retained at the

expense of the company, and the contractor gets full payment for it. This is done, however, only upon condition that the outbreak of the infectious complaint is at once reported. On the arrival of the milk at the establishment it is an invariable rule that its temperature must not exceed 10 degrees. The temperature of the milk in each can is therefore taken immediately on its arrival, and in the event of its being over 10 degrees C. it is rejected and employed in some other way at the expense of the contractor. Persons, specially appointed for the purpose, taste the milk in each can as soon as it arrives. These cans are sealed with lead at the farms from which they come, and if the milk has any disagreeable taste upon arrival it is rejected. Having passed through the above ordeal, separate samples of the produce of each farm are taken in order to discover the percentage of fatty matter contained in the milk and cream. The milk—both the sweet and the half-skimmed, also the cream—is then filtered. The filtering machine is simple, but effective in operation. This is done by putting them into an enamelled receiver, placed at a higher level than another vessel of a similar character.

The milk then, by its own pressure, rises up through the bottom of the lower vessel, passes through two layers of gravel of different degrees of fineness and several layers of fine cloth, and finally runs out through a pipe which is placed close to the uppermost edge of the receiver. It is quite inconceivable the amount of filth from which the milk is purified by this process: not only the more palpable dirt, which consists chiefly of hairs, scales, chaff, and similar matters, but also enormous numbers of bacteria. In the coarser gravel, up to 6,500,000 of bacteria have been discovered, and in the finer sort up to 17,500,000 per cubic centimetre.

From the very beginning of its career, one of the tasks which the company has undertaken has been how to supply specially wholesome milk for the nourishment of infants fed upon the bottle, the so-called "children's milk." The feeding of the cows which supply this kind of milk has been regulated so that these animals receive during the winter only hay, crushed barley or oats, and a small quantity of carrots. The children's milk is led direct from the filtering apparatus into clear glass bottles, which are then carefully corked and sealed with lead. The latest improvement introduced by the Copenhagen Milk Supply Company in its efforts to obtain the best possible milk for infants has been, not only to supply pure pasteurised milk in bottles containing an imperial pint, but also milk mixed with water and sugar in various proportions, according to the age of the child.

To destroy in the most effective manner any germs of disease that may possibly be present, the milk (both the pure and the mixed), in bottles specially constructed and corked, is heated up to a temperature of about 85 degrees C. After being kept at this temperature for half-an-hour, it is cooled down in the course of about twenty minutes, and then placed in ice. Milk prepared in this way will remain free from germs for at least twenty-four hours. The milk is bottled and sold in zinc stands or cruets, each containing the quantity necessary for twenty-four hours food, according to the age of the children. There is, in every cruet, a certain number of bottles, each of which contains milk enough for a meal. The bottles are of clear glass with tapering necks. They are first placed in lukewarm water to take off the chill, after which the cork is removed and an ordinary mouthpiece put on.

The number of farms supplying the milk is about 60, and the aggregate number of cows approaching 6,000. The regular staff of workpeople is about 300, in the proportion of 100 men, 70 women, and the rest boys. When any infectious disease breaks out among the workpeople or in their families, the party concerned is at once removed from the business, but he still receives his wages, if only the case has been reported at once. This description of the principles which govern the company, and of the manner in which these principles are adhered to, explains the confidence which the inhabitants of Copenhagen show the undertaking in an ever-increasing degree, while abroad,

in many places, it has been taken as a model for the establishment of similar institutions. Add to this that the company, from its very beginning, has never paid more than 5 per cent. profits, but has used everything above that amount towards increasing the business and disposing of the milk, partly gratis, partly at reduced prices to hospitals and kindred institutions and to the poor, then it may be safely said that seldom has private effort yielded more admirable fruits in the interest of health than those which owe their origin to the Copenhagen Milk Supply Company.

The milk comes from the farmers in cans holding just 1 cwt., and the farmers receive an average of 6½d. per gallon for milk the year round. The price the company gets for it is 10d. for whole milk, 5d. for half skim, and the infant's milk is charged at 1s. The milk is not put through a separator in order to get cream, but is set under the deep-pan system, during which no less than 3,000 tons of natural ice is used annually. In skimming the milk, from ½ to 1 per cent. of fat is left in it. These particulars were given by Mr. Busck, who also, in answer to a question, said that the average rent of land in Denmark was 20s. per acre, and that the very best often made 30s. The bottling of the milk is a simple process, and altogether some 3,000 of cream and 3,000 of milk are filled per day. This work is mostly done by women. When there is milk which is not up to the standard, it is made into butter or cheese, after being pasteurised. The butter is sent out in nice dishes, and the skim milk is made into cheese for the local market.

The party inspected the works of the Scandinavian Preserved Butter Company at Copenhagen. Here butter is received in 1-cwt. barrels from the farmers, and on its arrival it is taken out and washed on the outside to remove any salt, and scraped. It is then put into the worker, a little salt added, and worked until it is free from butter-milk. It is then pressed into 1-lb. or ½-lb. tins, soldered up, lacquered, and labelled, and packed up in cases for export. During the year about 1,000,000 tons of butter is packed in this establishment. Some farmers send no less than 50 or 100 barrels weekly, and not a few contrive, by the timely breeding of their cows in the autumn, to send in more butter in the winter than in the summer. It was stated that the butter was slightly coloured artificially by the farmer, but that there was no blending of butter: each farmer's butter was kept separate, and by selection they were enabled to keep uniform quality in two different qualities. In winter the butter is from sweet cream. The company was established thirty-five years ago, and it has had a good run of business, which continues now, although the effect of opposition is felt.

The appointment of dairy experts is acknowledged to have been a step in the right direction for the rapidly increasing development of the dairy industry, and the dissemination of experience from one place to another. To act in a similar way as the dairy expert appointed by the Royal Agricultural Society, three consulting dairy experts were appointed by the State during the years 1888-9, and in 1896 a fourth, these four having the country divided between them. Any dairy or agricultural society can call in their assistance for one or more days, by merely paying their travelling expenses. These dairy experts, paid by the State, have done a great deal of good by visiting dairies where the quality of the butter was unsatisfactory, and advising how to improve it; by imparting information as to improved methods; by acting as judges at butter shows; and by reading papers at the many shows held by agricultural societies in different parts of the country. The State has furthermore appointed an engineer, whom the dairies can consult as to the use of machinery, and especially as to the use of steam power. His whole time is taken up by this consulting work, his endeavours being specially directed towards effecting greater economy in coal consumption. Competent veterinary surgeons have been appointed to act as consulting experts in the breeding of cattle and pigs, and experts have also been appointed abroad to study questions concerning the transport of and trade in agricultural produce.

As the development of the dairy industry is principally dependent upon a good stock of animals being kept, it is right to mention that the State has for many years and in various ways tried to assist in the improvement of stock, and to encourage the breeding of dairy cattle and pigs. Cattle shows are the most important means used to this end. There are local shows held in all parts of the country, and larger shows for certain districts; and the State gives a yearly grant of increasing amount. Partly with the assistance of the State, papers have been read at the meetings of local agricultural societies and farmers' clubs. Associations for the breeding of cattle have been assisted by the Government in the purchase of good bulls, and recently formed associations for the examination of the milk of individual cows can obtain a small subsidy, which is given to encourage the formation of more such associations in different districts. Within the last few years centres have been formed for the production of pigs for breeding purposes, and have obtained small grants from the State. A Government grant, originally of £2,800 (now increased to double this amount), is voted for the purpose of stamping out tuberculosis in cattle—a measure which it is hoped will prove of great benefit to the Danish dairy industry, not because tuberculosis is considered to be more prevalent here than in other countries (for I think this is far from being the case), but because the stability of the dairy industry is dependent upon the healthy condition of the milch cows being maintained, in order that the best individuals may be retained for breeding for many years (for unfortunately it is frequently the best individuals which are the easiest attacked by various forms of tuberculosis and other diseases).

Some notes relating to the export of butter may here be of interest. From the tables given it will be seen that by far the greater part of the butter is exported to England, and also how the remainder is divided between other countries; also, that the export to England is chiefly from Copenhagen, but that many other ports take part therein. The State has assisted the export trade by a considerable development of the railways (special refrigerator vans have been built for the conveyance of butter during the warm weather); and by keeping the waterways open in winter time, especially the Belts and the Sound north of Copenhagen. Powerful steamers, capable of breaking through the ice, have been constructed. During the years 1894-5, when the exports from Esbjerg rose considerably, many other ports were closed by ice. This new harbour at Esbjerg was begun by the State in the year 1871, and it has an increasing importance for the export of butter, but a still greater importance for the export of bacon, of which by far the largest part is shipped from this port to London.

EXPORTS OF BUTTER FROM DENMARK TO VARIOUS COUNTRIES.

To	Year ended 30th September.		
	1894.	1895.	1896.
	Cwt.	Cwt.	Cwt.
United Kingdom	1,113,863	1,132,436	1,188,671
Germany	21,229	14,090	21,001
Sweden	1,742	3,782	2,402
Norway	1,817	1,116	1,118
Holland	2,047	1,327	1,059
Belgium	467	170	460
Spain	1,446	954	2,198
America	1,821	620	143
Copenhagen	...	2,015	4,930
Other Countries	680	734	1,377
Total	1,145,112	1,157,244	1,223,359

EXPORTS OF BUTTER TO THE UNITED KINGDOM FROM VARIOUS DANISH PORTS.

From	Year ended 30th September.		
	1894.	1895.	1896.
	Cwt.	Cwt.	Cwt.
Copenhagen	589,470	541,780	655,220
Helsingor	...	17,150	...
Esbjerg	175,700	261,380	206,680
Odense	106,130	84,060	92,130
Aarhus	83,610	76,800	77,180
Horsens	27,510	19,640	14,220
Randers	54,380	49,920	50,730
Svendborg	29,900	25,610	28,360
Frederikshavn	14,060	20,440	17,020
Aalborg	24,740	25,990	29,320
Nyborg	...	...	.
Nakskov	3,740	4,680	8,150
Nykjobing F.	4,620	4,980	9,660
Kolding	...	..	.
Grenaa	...	.	..
Total	1,113,860	1,132,430	1,188,670

SCANDINAVIAN CO-OPERATIVE DAIRYING.

CO-OPERATIVE dairying is extensively engaged in both in Denmark and Sweden. Examples are the co-operative dairies at Mellose (Denmark) and Lund (Sweden).

CO-OPERATIVE DAIRY AT MELLOSE.

To Mellose there belong 65 members, who send 14,000 lb. of milk per day. The milk is separated with a Laval, and the cream is pasteurised, afterwards being ripened with a pure ferment, the ripening occupying about eighteen hours, temperature being regulated. The butter is not washed in the churn ; it is taken out in a small sieve, which is placed in a tub of water ; the latter rises through the grains, and it carries away the butter-milk. This appears to have an advantage over the putting of water into the churn. Salt is used to the extent of 3 per cent., and is added at the time of working on a revolving table. The butter is placed in tubs containing about 1 cwt., and sent to Copenhagen. There is an ice-house in connection with this, as with all other dairies visited, the ice being obtained from one of the many lakes which are dotted over the country.

CO-OPERATIVE DAIRY AT LUND.

There belong to this dairy 120 farmers, and it is managed by a committee of seven. The cows kept vary from one to forty in number, and the supply is about 6,000 gallons daily. The milk is delivered once daily, and 80 per cent. of butter-milk is taken away by the farmers. The average weight of milk is 26 lb. to 1 lb. of butter ; at the present time it is 24 lb. The cattle in this neighbourhood are Dutch black and white, with a mixture of Ayrshire. The milk is separated at 40 degrees Celsius, and the cream and the skim milk pasteurised at 72 degrees. A pure culture is used, and the butter is worked on a rotatory table, salt being added during working ; it is then packed in tubs, and sent to market, one-fifth going to Copenhagen (where it was said to be sold as Danish butter), and four-fifths disposed of at Malmo, Gothenburg, Helsinore, &c. This dairy was built two years ago at a cost of £2,500, exclusive of the land. A co-operative dairy, three times the size of this, is now being built at Malmo.

CONCENTRATION OF BUTTER AND CHEESE MANUFACTURE.

FROM a short review of the systems and processes pursued in the several countries and colonies which supply the markets of the United Kingdom with dairy produce, which appears in the *Board of Agriculture Journal*, it is clear

that one feature which is more or less common to them all is the concentration of the manufacture of butter and cheese in large dairies and factories, co-operative or otherwise, drawing their supplies of the raw product from a number of farms situated within a convenient radius. In the greater number of these establishments the whole of these processes of manufacture are carried out on the premises, but some of them are equipped only for the manipulation of the cream, and in Normandy and Brittany the butter factories confine their operations to the blending and grading of the manufactured product. The object of all is, however, the same—viz., the production of an article of uniform quality and appearance at the lowest possible cost; and the facts illustrated by our import statistics afford *primâ facie* evidence that the factory system has worked with success abroad, especially in countries where it is combined with co-operative principles, of which Denmark is a notable example. Attention may also be directed to the progress of co-operative dairying in Ireland. According to the latest report of the Irish Agricultural Organisation Society, the dairy societies or creameries in Ireland now number 93, including 10 auxiliaries or branches, with a total shareholding membership of 8,750. The quantity of butter produced by the societies in 1896 amounted to 2,791 tons, and the average price realised was 95s. 8d. per cwt. The average price paid for milk supplied by the shareholders was 3·55d. per gallon.

The General Purpose Cow.

By JAMES MOFFAT

The bad odour in which the Durham is held as a milker by the present generation of Australians, is only justified by their experience of this breed being limited to Australia of the last twenty-five years. Thirty years ago we had many herds of splendid milking Durhams that would have realised as springers £26 per head in the markets of Scotland, at least £10 per head over Ayrshires. In fact, there was then no scarcity of good milkers, and never a suspicion of either Ayrshire or Jersey blood existed amongst them.

The early settlers of New South Wales had imported Durhams in the early days of the colony at a time when they were still best known and famed for milkers under the name of "Teeswaters," and their stock remained good for milk down to the end of the sixties. After this, the open-shouldered, square, beefy Durhams became common, and gradually the milking qualities of our cattle disappeared. In 1883 I travelled a good bit amongst the farms of New Zealand, and saw some of the most noted herds of Ayrshires—E. K. Ferguson's, of Blueskin, amongst others—but in every instance the Durham herds of their neighbours were more valuable even for dairy purposes, taking no account of their much greater value as butchers' cattle.

The cross of a Durham bull from a milking strain on other breeds has so frequently proved so successful in producing record milkers, that the wonder is that there should be any doubt as to its superiority for improving the milking stock of the colony.

The cross betwixt an Ayrshire cow and Durham bull is at present the established favourite of the dairy farmers of Scotland. Some forty years ago, cows we bred in Scotland on those lines were extraordinary milkers compared with the Ayrshires under same treatment as to byre and pasturage.

In Yorkshire, the home of the milking Durham, a West Highland Kyloe heifer, bred to a Durham bull, produced an animal that excelled as a butter cow the breeder's Durham stock; and yet the Kyloe is not a milk breed by any means.

Recently, in the South of England, the record milker was bred from a Devon cow and Durham bull, and the Devon is not reckoned amongst the milk breeds.

In horse breeding, if a small thoroughbred mare is bred to a heavy draught horse, the progeny will be given a heavy top, while the gaskins will be quite thin and deficient; and this happens, though both sire and dam had good gaskins. For the same reason, the Durham, being heavier than the Ayrshire, Devon, or Kyloe breeds—when crossed on those breeds—gives breadth on top, and reduces the weight of flesh on thighs, and thus gives better lines for a milk-producing animal, and adds many units to her total number of points as a milker.

This fact, I believe, accounts in a great measure for the success bulls of a Durham milking strain have in producing record milkers from such breeds as Kyloe, Devon, and Ayrshire.

Breeding horses for work, cattle for beef, or pigs for hams—if the male animal be of a smaller type or breed than the female, the best results will be obtained; but, in my experience, the reverse seems to hold good when breeding for milk.

By using Devon or Kyloe cows and a Durham bull, the progeny retain the rich quality of milk of the dam; and the breadth given above the pail with the thin thighs all tend to produce better lines for milk than either the Kyloe, Devon, or Durham parents possessed.

The Normanby cattle I alluded to in a previous paper had evidently been bred from cows of a Celtic origin with bulls of a "Teeswater" strain. Beside

the Normanby herd, around Ipswich there were many good milkers of a Devon type and colour, with Durham strain showing up. They were not so grand as the Normanby mouse-coloured cows; still, cows of this Devon type we milked thirty years ago, were as good milkers as we had ever been accustomed to in Scotland.

In 1867, passing Blythdale Station, near Roma, in the milking-yard there were pure Durham cows of such milking qualities that, fresh as I was from the cattle markets of the old country, where such cows would readily fetch £26 per head, I could not abstain from calculating possible margins of profit on shipments.

The advocates for a single purpose cow—who affirm that a general purpose cow cannot and does not exist, that at the same time will be a good butcher's beast, and be equally as good a milker as the Ayrshire and Jersey—have certainly small grounds for their assertion.

If we confine our attention to the present state of the herds of Queensland, their assertion may appear to have confirmation; but if we take a look back at the facts as they present themselves to us—before the insane craze for beefy types took possession, even of our dairymen, who felt constrained to follow the craze and obtain bulls from the stations of this beefy type, with the result that in developing deep fleshy thighs and open shoulders they lost their milk—we can only come to the conclusion that the poor men were generally so inexperienced, that they neither knew why they had lost it nor how to regain it.

Now they have been advised, they will find it by going for purposed breeds. Let us grant they will. Is it advisable to secure milk by sacrificing to such an extent the value of the cow for butchers' purposes, when milk can be obtained without this sacrifice? I am of the opinion, "No."

In the earlier times and up to thirty years ago, the cattle-stock of Australia were good general purpose animals. To-day, in the Illawarra district they remain so, and yet have a record for milk that pretty nearly beats the world.

In my remarks on the Devon and other Celtic cattle, I omitted mention of their horns. In this respect their likeness to the herds of ancient Egypt is somewhat remarkable. The horns of the red Egyptian cattle are shown to be similar to the Devon of to-day. At the same time with respect to the horns of the cattle worked and owned by the Egyptian agriculturists as depicted working in plough and threshing-floors we could imagine the ancient artists had secured modern West Highland Kyloes for their models. Our Australian experience at once convinces us that great judgment, experience, and observant intelligence had all been combined in raising this class of cattle—that, in fact, we are only beginning to understand a few of the many qualities those ancient Egyptians had concentrated into their herds. It is a strange fact that, if our most intelligent bullock-drivers were the only parties to be consulted as to what type of horn was best, our cattle would have horns exactly similar to those owned and worked by the ancient Egyptian farmers, the reason simply being that cattle with this horn are intelligent, docile, and tractable, train readily to understand and obey, and become valuable as leaders. On the other hand, cattle with hoop or inturned horns of a pure Durham type remain only fit for body of team purposes. Amongst Australian herds of Durhams there is a frequent reversion to a Celtic type of horn—evidently throwing back on the South American cows which were largely imported in the early times of our settlement; and we find our bullock-drivers, when picking steers for work, invariably select animals showing this reversion. Amongst the ancient Egyptian cattle, just as amongst the Celtic cattle of to-day, there existed a polled variety; but it seems to have been a grazier's animal, not an agriculturist's. If we may judge from the fact that we invariably find it represented with calves at foot at large cattle musters (of a bangtail order for cows), it was evidently a large grazier's animal, not a small farmer's; it seems to have occupied much the same position in ancient Egypt which the Galloway does to-day in Scotland—a grazier's beast rather than a general purpose one.

Fruit Culture in Queensland.

By ALBERT H. BENSON,
Government Fruit Expert.

Having laid off the orchard, the next thing is to plant the trees; but before dealing with this it may be as well to say a few words as to the kind of trees that should be obtained for planting. In the first place, if the trees are worked ones, then care should be taken to see that they are worked on suitable and healthy stocks—a matter that will be dealt with fully later on; that they are well worked—that is to say, that the scion, be it bud or graft, has made a perfect union with the stock, and that there is no dead wood or an unsightly blemish at the point of union, and also that the scion has been trained in such a manner that the tree is straight, clean, and well grown. Such a tree, if carefully lifted in the nursery, is the best that can be obtained, as, when planted out in the orchard, it will grow right away, and it can be pruned to any shape that may be considered best for any particular variety or district. Always see that the trees have good roots—not long straggling roots without any fine fibre, but good fibrous roots that are not broken or bruised to any extent. Yearling trees—that is to say, trees that are of one year's growth from the graft or bud—are always to be preferred, as they soon get over the shock of moving. Too large trees are not desirable, a medium-sized tree being preferable; but all old, stunted, badly worked, or badly grown trees should be avoided, as they seldom pay for the labour of planting, and even though they may occasionally make good trees eventually, for years they are smaller than well grown and carefully selected trees. Don't run away with the idea that because such trees are often to be purchased for a small price, that therefore they are cheap, as this is far from being the case; the time lost and the disappointment arising from planting them, often making them dear trees, even if they were obtained for nothing. If you want to make fruitgrowing pay, plant good trees and plant them well; don't plant staggy or badly grown rubbish. Examine all trees carefully for scale insects of all kinds, or for other insect or fungus pests, especially if they are being taken into a clean district, as a little care now may mean the saving of much hard and expensive work in the future. It will pay those who may be starting fruitgrowing in new districts, where there are few indigenous fruit pests, to dip all deciduous fruit trees for two minutes into a mixture of soft soap and water—1 lb. of soap to every gallon of water, the mixture to be kept at a temperature of 120 degrees F.—or to fumigate all citrus and other evergreen trees with hydrocyanic acid gas for an hour. To fumigate the trees, place them in an airtight box of sufficient size to hold them, say a box 5 feet high by 4 feet deep by 2 feet wide—that is of 40 cubic feet capacity; put a common earthenware basin in the bottom of the box; place $\frac{3}{4}$-oz. of sulphuric acid and $1\frac{1}{2}$ oz. of water in it, taking care to add the acid slowly to the water, and finally add 212 grains of 98 per cent. cyanide of potassium. Place a bit of sacking over the basin, and shut the box tight, being careful not to breathe any of the fumes of the gas, as it is of a very deadly nature. All trees could be treated by fumigation, but where there are no evergreen trees the soap solution would be sufficient.

Planting the Trees.

Examine the roots carefully; cut away all bruised roots, taking care that the cut is made from the under side of the root, so that when planted young rootlets will start from the cut surface at once. Do not cut away any fibrous roots, but if there are any long straggling roots they should be shortened.

Take especial care not to plant the tree too deep, as too deep planting is very often the cause of orchards failing. More fruit trees are ruined by too deep planting than by any other cause. The right depth at which to plant the tree is as nearly as possible the same depth at which it stood when in the nursery. If the land has been well worked, there is no necessity to dig large or deep holes; in fact, if the soil is at all tenacious, no greater mistake can be made than to dig the holes deeper than the surrounding soil has been worked, as, by doing so, you simply create a basin to hold stagnant water right under the centre of your tree. In digging the holes, keep the top soil separate from the subsoil, and see that the centre of the hole is kept rather higher than the sides, so that when the tree is planted the drainage will run from and not towards the trunk. Spread the roots out well and evenly, it being a good plan to set the tree in such a manner that the strongest root is on the side from which the heaviest winds may be expected, as this will tend to brace the tree against such winds. Place a little fine soil round the roots, taking care that every root comes into direct contact with the soil, and that they are not massed together; also see that there is no space between them and the soil, as in this case the tree is apt to dry out, whereas when fine soil is placed firmly round the roots, there is no fear of this taking place. Don't trample the ground too tightly, especially if it is at all wet or heavy, as by doing so you will sour and harden it, but give it enough pressure to firm the roots properly. If the land is very dry, a bucket of water may be given to each tree now, and as soon as this has soaked in, the hole may be filled up; this is better than watering from the top after the hole has been completed, as the water lasts longer and there is no fear of the surface caking. Don't place any stable or farmyard manure in the bottom of the hole, but if it is desirable to manure the tree at the time of planting, then a couple of shovelsful of well-rotted manure, or 2 or 3 lb. of boiling-down refuse, can be well mixed with the soil that the tree is planted in. Fresh stable or farmyard manure should not be used, but can be applied with advantage, as a mulch to the tree when planted.

The following illustrations, which I reproduce from an article of mine written for the *Agricultural Gazette* of New South Wales, show (Fig. 1) a tree properly planted, and (Fig. 2) a tree improperly planted:—

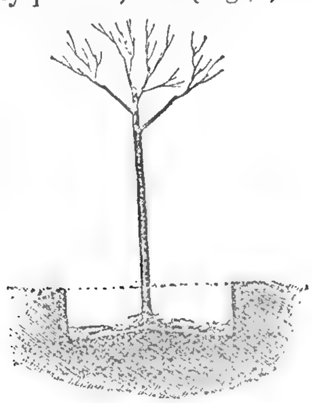


Fig. 1.

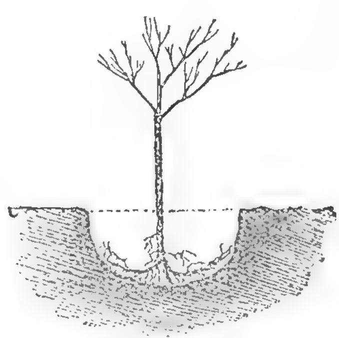


Fig. 2.

In order to plant the tree exactly in the same spot that the stake that was used for marking out the ground occupied, the following simple device will be found very handy: Take a piece of wood 4 to 5 feet long by 4 to 6 inches wide by 1 inch thick, bore a hole ¾-inch in diameter about 2 inches from each end, and midway between these two holes saw out a broad V, as shown in the accompanying illustration (Fig. 3). Get two round pegs of wood of such size

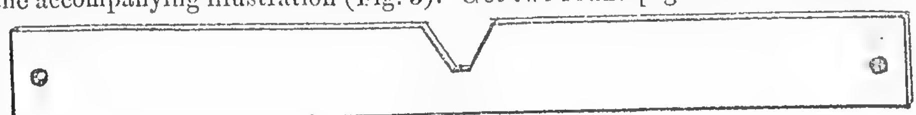


Fig. 3.

that they will pass easily through the ¾-inch holes at the ends of the planting-board, and of about 18 inches in length. Place the planting-board on the ground, so that the stake fits into the V, and then drive the pegs through the holes at the ends, leaving them 3 or 4 inches above the board. Then lift the board over the pegs, remove the stake, and dig the hole. When ready to plant, replace the board and place the tree so that the stem will fit into the V, and the tree will thus stand in exactly the same spot as that occupied by the stake. The planting-board is also of value in showing the depth at which to plant, the top of the board being 1 inch above the level of the surrounding ground, so that the depth at which the tree is planted can be seen at a glance, and the hole can be deepened or filled up as required to suit the tree that is being planted.

Cutting-back at Planting.

Cutting-back at planting is the first and most important step that is taken in the formation of the future tree, and the grower who neglects to cut back at planting prevents, in a great measure, the vigorous development that takes place when the tree is properly started, and also, no matter what the subsequent pruning may be, the tree will never be as symmetrical or as evenly balanced, if unpruned when planted, as it would be if properly cut back. The removal of the tree from the nursery has destroyed the greater portion of the fibrous roots of the tree, so, in order that the top may correspond with the reduced root system, it must be cut back. When a tree is planted out as received from the nursery, without being cut back, there are a large number of buds on it, most of which will start, and the energies of the tree will be divided between them, with the result that, instead of a few strong branches being formed, a number of weakly and useless twigs will be produced. On the other hand, when the tree is properly cut back, and only three, four, or five buds, that are required to form the main branches of the tree, are allowed to develop, then the whole energy of the tree is thrown into those buds, and the result is the formation of three, four, or five vigorous shoots, that are evenly balanced, and that are just where they are required to form the future main branches on which the tree is to be grown, no matter what system of pruning is afterwards adopted. The height at which to cut back is a matter of considerable importance, but in nearly every instance, in Queensland, it is best to head low. The extreme height should in no case exceed 2 feet, and in most instances 1 foot is to be preferred. Low heading protects the trunk from sunburn, as the spread of the branches shades the ground around it; renders the tree less liable to damage from wind; the fruit is easier gathered, and, if properly pruned, improved implements of cultivation can work the whole of the land right up to the stem if necessary to do so. The following illustration (Fig. 4) shows the method of cutting-back at planting, and it is best to make the cut lean from, and not towards the midday sun. In windy districts it is also a good plan to leave the top bud pointing in the direction of the prevailing wind, as this will tend to balance the tree. Always see that the tree has only one main stem, no matter whether it is only 6 inches long, as the common plan of growing trees, especially citrus, as a bush with half-a-dozen or more branches starting from the ground cannot be too strongly condemned, as such trees can never be kept free from insect or fungus pests, as they usually grow in such a dense mass that it is impossible to get any spraying material into the centres of the trees.

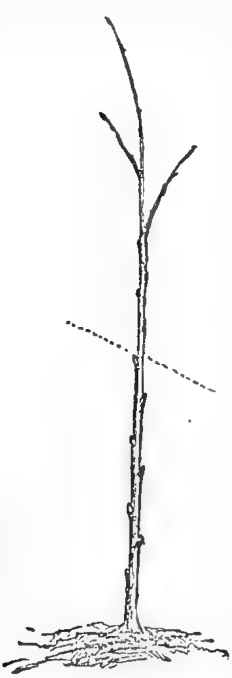


Fig. 4.

Cultivation.

Thorough cultivation of the soil is a *sine quanon* of successful fruit culture, especially in dry districts or in districts where, even though the rainfall is large, it is yet precarious, and there are considerable periods in which no rain falls. In order to make fruitgrowing pay, you must grow good fruit, as the time has now come when inferior fruit is a drag on the market and is unsaleable, whereas really good fruit will always find a market; and really good fruit can only be produced, with any degree of certainty, when the land is kept in a high state of tillage. Therefore, in order to make fruitgrowing pay, you must cultivate your orchard thoroughly.

Keep the orchard clean. No orchardist can afford to grow a crop of weeds and a crop of fruit at the same time. If it is too much trouble to keep the orchard clean, then the best thing the owner can do is to quit growing fruit; he was not made for an orchardist, and should take up some easier line of work. Rest assured that if an orchard planted with the right varieties, in a suitable soil and district, can only pay when given thorough care and attention and kept in the highest state of cultivation and free from all fungus pests, a neglected, ill-pruned, ill-cultivated, and diseased orchard will stand a very poor chance, besides being a disgrace to the district and a propagating and disseminating ground for every kind of disease that fruit is subject to. Thorough cultivation is of the greatest importance to the orchard, as, besides keeping the land clean and friable, it is the surest way of retaining moisture in the soil during a dry time. Where uncultivated land will dry right out and be perfectly unworkable, the same ground properly cultivated will retain all the moisture necessary for the trees' growth, and, what is more, should there be a shower at any time during the dry spell, the cultivated land will absorb and retain all the rain that falls, whereas the uncultivated land will absorb little, if any, the greater portion running off the surface and being lost. Every weed growing in an orchard in a dry time is robbing the trees of the water required for their proper development; so, therefore, if for no other reason, the orchard should be kept as clean as possible. Besides this, the growth of weeds and the accumulation of rubbish in an orchard form the best of shelters for many injurious fruit pests, and render it difficult to deal successfully with them.

Thorough cultivation is the best remedy against drought, in that by keeping the surface of the soil in a fine state, and never allowing it to set, the surface acts as a mulch, and prevents the loss of moisture from the soil by surface evaporation. By preventing the surface soil from setting, you prevent the formation of capillaries right to the surface of the land, and it is through the capillaries that surface evaporation takes place. Every orchardist knows how moist the soil keeps when covered by a mulch of straw, leaves, or bush-raking, and a soil mulch produced by thorough cultivation has the same results, and for the same reason—viz., that it prevents surface evaporation. The method of cultivation to be adopted is the same in all cases, the implements used depending on the nature of the soil and the size of the orchard.

Plough the orchard during the winter, and cultivate during the summer. Ploughing tends to sweeten the soil, and to break up any pan that may be formed, as well as to bury any weeds and trash that may have gathered in the orchard after the summer cultivation is dispensed with. Plough the orchard as soon as it has been pruned, and leave it in the rough, so that any sourness in the soil may be sweetened. Plough well, the depth depending on the variety of fruit and the nature and depth of the soil. Use implements that turn the soil right over, and for this purpose the short-breasted American ploughs, of a similar type to the illustration herewith, are the best, being easier to pull, better to handle, and doing more work than the ordinary English type of plough. In small orchards a single-furrow, one-horse plough (Fig. 5) is all that is required, but in large orchards two, three, or four gang ploughs can be used if the trees are planted at a proper distance. All the land that can be turned over by means of big ploughs should be so treated, and that close to the trees

should be ploughed with single-furrow, one-horse ploughs, fitted with special side draught, so that the whole of the land can be ploughed right up to the line of trees.

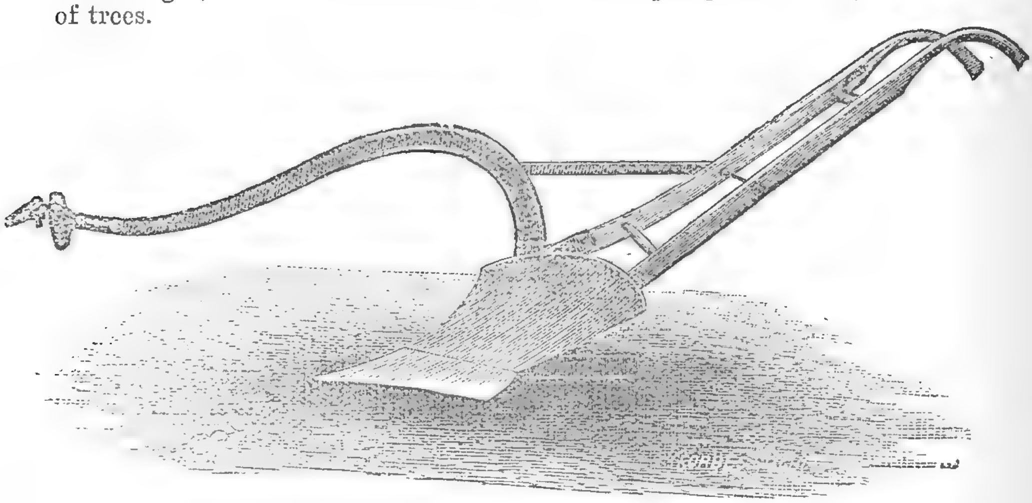


Fig. 5.

The object of summer cultivation is to stir the land, not to turn it. As I mentioned before, it is the prevention of the formation of the capillaries in the surface soil, by keeping it in a state of perfect tilth, that prevents the surface evaporation of moisture. No cultivator should be used which turns the soil or throws it up in ridges, as this will rather tend to dry out the ground by bringing moist soil to the surface, and also, the land being in ridges, there is a larger surface exposed to the influence of the sun and air than if it is left even and level. Ridges are also to be guarded against, as in the case of heavy rains, such as thunderstorms, they form channels for the water, and tend to cause washing. It is a mistake to expect the same implement to kill weeds and stir the land properly at the same time. The coulters that are best suited for stirring the land are of little value as weed-killers, as they do not cut any extent of the surface. Where weeds are troublesome, they should first be got rid of by coulters made for the purpose, or by means of specially made weed-knives (Fig. 6).

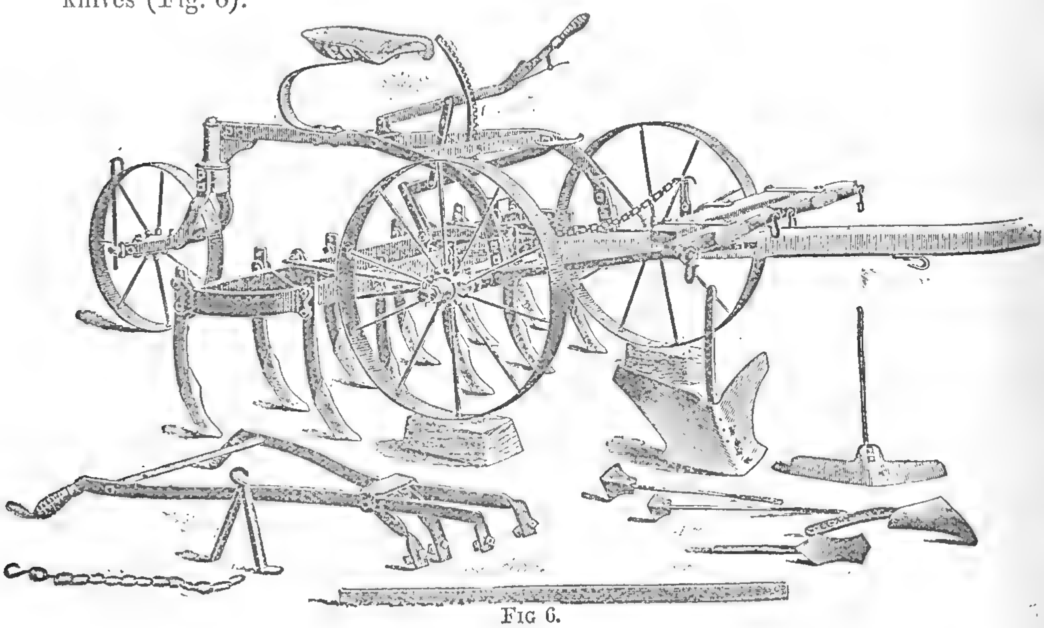


Fig 6.

For summer cultivation, implements of the Planet Junior type, worked by one horse, and fitted with sets of teeth for surface working to kill all weeds, and with narrow cultivator-teeth to stir the lands deeply, are the best for small orchardists (Fig. 7); whereas for large orchardists two-horse implements, such

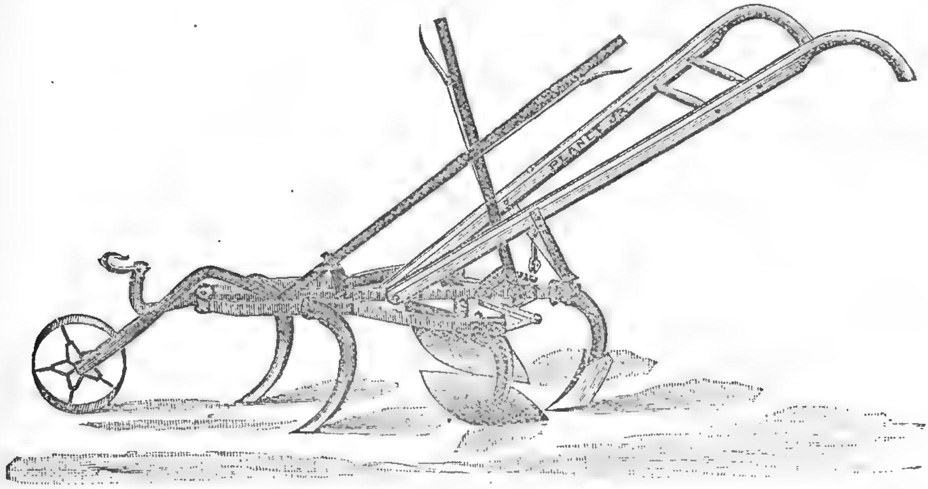


Fig. 7.

as the Planet Senior, Top-Notch cultivator (Fig. 8) or Morgan spading-harrow,

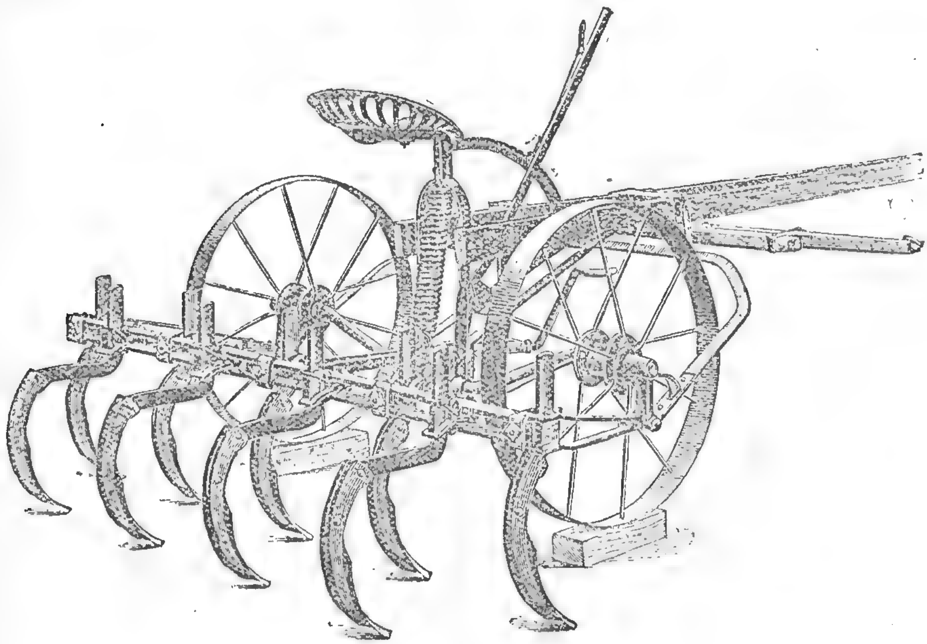


Fig. 8.

are to be preferred. The latter (Fig. 9) is a splendid orchard implement that reduces the surface soil to a very fine state, and consequently renders it a good mulch, as the finer the surface soil the more perfect the mulch and the less the surface evaporation. There are two great secrets in summer cultivation. The first is to work the land at the right time, and the second is never to allow a crust to form. After heavy rain the cultivators should be kept going as hard as possible—as soon as the land will carry the horses without packing—because the sooner the surface of the soil is stirred after rain, the finer will be the tilth obtained, and more moisture will be retained in the soil. Never neglect this.

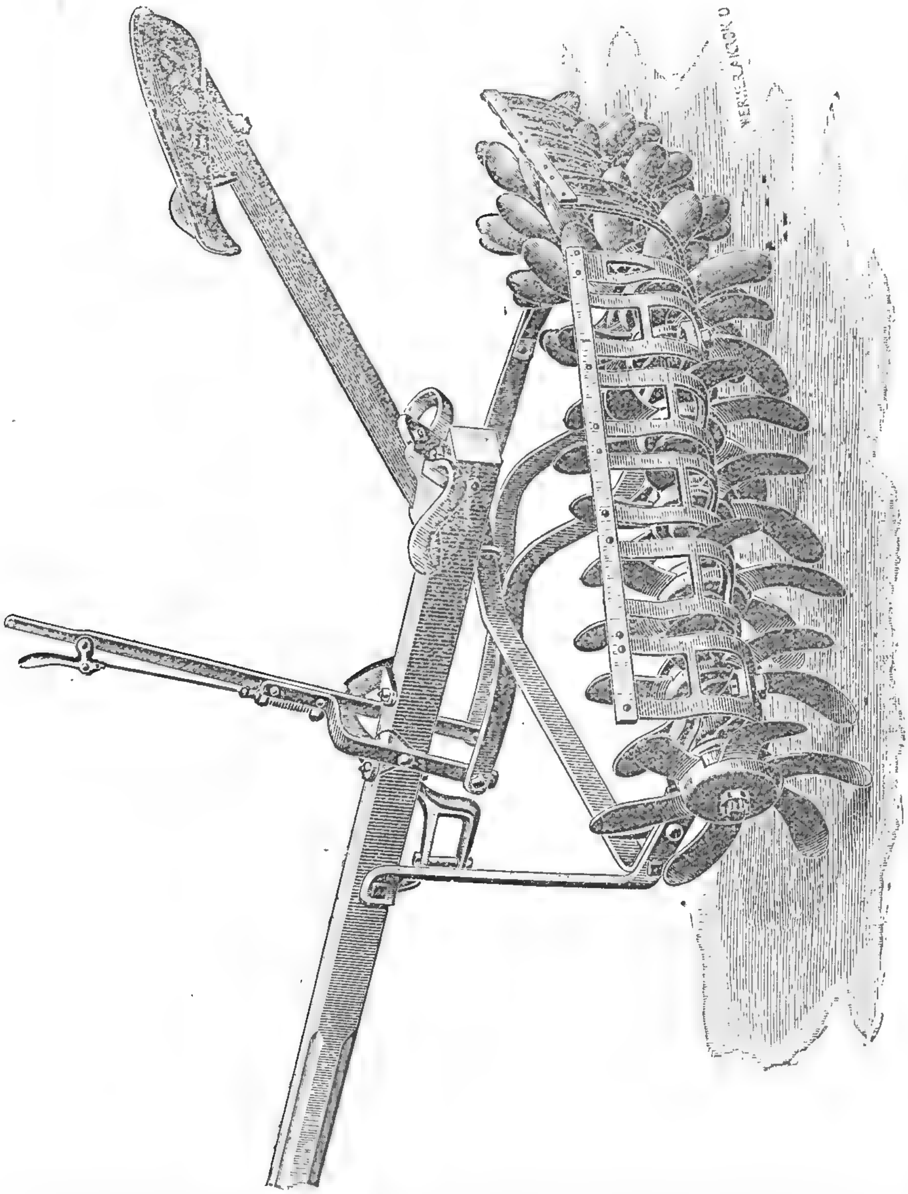


Fig. 9.

Remember that the more moisture you can retain in your soil in a dry district, the better the returns, and neglecting to retain the moisture when you get it, very often means the loss of your crop. You cannot over-cultivate if you cultivate properly. Stir the land, and stir it deeply. Do not turn the soil. If you do, you bring moist soil to the surface and consequently lose moisture; therefore, use the narrow teeth that stir but do not turn the soil.

Orchard Manures.

By WALTER SCOTT CAMPBELL,
Department of Agriculture, New South Wales.

The proper and economical use of manures for orchards is by no means the simple process it might at first sight appear to the uninitiated, and indeed it is probably by no means so thoroughly understood in the Australasian colonies as it is desirable that it should be. The older our orchards grow, the more and more necessary it is that all who are concerned or interested in fruit-production, should make strong efforts to learn the best methods of prolonging and increasing the productive capabilities of the orchards, by applying the right kinds of manures at the proper times and in the most economical manner. Such knowledge can only be accurately attained by carefully conducted, exact experiments, but, as far as I am aware, no really satisfactory and conclusive experiments have ever been carried out in any of the Australasian colonies. However, if any of the representatives of the various colonies present at the Conference to-day may be able to throw any light upon this point, I trust they will do so in the discussion that I hope will follow the reading of my paper. I have every reason to think that, in course of time, exhaustive experiments will be made by the Department of Agriculture in New South Wales, whereby valuable information on this important subject will be gleaned; and this, I need hardly say, will be made available for all. In the United States of America some few important experiments have been carried out, and to some of these I shall presently refer.

I may mention here that many years of observations in orchards, both in New South Wales and other colonies, have led me to conclude that the importance of taking the proper and careful initiatory steps which should be taken to lead to success have, in planting orchards, only too frequently been sadly neglected. The soil is indifferently prepared, draining entirely neglected, or the situation has been quite unsuitable. In the course of a few years—sometimes a very few—the orchards fail to produce satisfactorily; some of the trees gradually die away, and innumerable insect and fungoid pests take almost entire possession. Many orchards become entirely neglected, and these form admirable breeding-grounds and nurseries, whence pests of all kinds can quietly and undisturbedly distribute themselves far out wide to become curses to the districts in which such orchards are situated. At times manuring of some sort is resorted to, and perhaps with partial success for a short time, but the mistakes first made when the orchards were formed seem to be seldom considered or understood.

If an orchard be planted on fairly good soil, in a good situation, the land being either naturally or artificially well drained, and the necessary cultivation and attention be carried on year after year, there will probably be no need of manure until the trees have produced several or even numerous crops of fruit. Now, there are millions of acres of excellent land in good situations in the Australian colonies where the very best of all kinds of fruits can be grown, if orchards be established on proper principles, and if those who plant will only confine their operations to areas which are sufficiently within their means to cultivate and care for as should be the case. It stands to reason that it must be far more satisfactory to produce an amount of best quality fruit on one acre, than it would be to produce double the quantity of inferior quality on two acres; but this rarely seems to be considered, and it is too often the case that great mistakes are made in the making of orchards of such large areas that the owners cannot possibly do them justice after planting. Nor will the application of manures mend matters, for this, it seems to me, is not infrequently thought to be the remedy for all evils.

You are all probably aware that manures are classed as general and special, and that the latter are frequently known as complete or special fertilisers; and you are also aware that the particular substances which fruit trees, as well as all other plants, need for food in good quantity in the soil, and therefore more likely to be exhausted

soonest, are nitrogen, phosphoric acid, and potash. There is another substance—lime—which is necessary, not only for food to a slight extent, but also for other purposes. The numerous other substances necessary for plant life are, as a rule, so abundant in soils that they need not now be considered.

It is always desirable to ascertain by chemical analysis whether nitrogen, phosphoric acid, potash, and lime are present in the soil and subsoil in satisfactory quantities, for although one or more of them may not be in such a condition as to be immediately available for food, it is possible, to a very considerable extent, to make them so, and thorough cultivation combined with good drainage will largely conduce to this end.

The following table of analyses of the ashes of various fruits, as well as of leaves and wood of some of them, shows the different proportions of potash, phosphoric acid, and lime they contain:—

	Potash.	Lime.	Phosphoric Acid.	Soda.
Orange—Fruit	36·42	24·52	11·07	...
,, Seed	40·28	18·97	33·24	...
Pineapple—Fruit	49·42	12·15	4·08	...
Fig—Fruit	28·36	18·91	...	24·14
Strawberries—Fruit	21·07	27·01	8·59	...
Greengage—Fruit	59·21	10·04	12·26	...
Apple	55·68	4·08	12·34	...
Quince—Seeds	27·09	7·69	42·02	...
Lemon—Seeds	33·39	12·87	34·89	..
Vine—Wood	27·88	36·26	13·18	...
Apple—Wood	19·24	63·60	4·90	...
Cherry—Wood	24·78	28·69	7·73	...
Orange—Roots	15·43	49·89	13·47	...
,, Leaves	16·51	56·38	3·27	...

Wickson in his work on Californian fruits gives instructive information showing the quantities of soil ingredients withdrawn by various fruit crops:—1,000 lb. of grapes withdraws 5 lb. of potash, 1·52 lb. of phosphoric acid, and 1·70 lb. of nitrogen. Reckoning a crop at 10,000 lb. per acre, this gives 50 lb. of potash, 15·20 lb. of phosphoric acid, and 17 lb. of nitrogen withdrawn from the soil. A crop of 20,000 lb. of seedless oranges per acre withdraws from the soil 55·60 lb. of potash, 13·40 lb. of phosphoric acid, and 53·80 lb. of nitrogen. A crop of 20,000 lb. of pears per acre withdraws 36 lb. of potash, 10 lb. of phosphoric acid, and 12 lb. of nitrogen. A crop of 30,000 lb. of plums per acre withdraws 51·60 lb. of potash, 13·20 lb. of phosphoric acid, and 167·7 lb. of nitrogen. A crop of 20,000 lb. of apples per acre withdraws 16 lb. of potash, 6 lb. of phosphoric acid, and 12 lb. of nitrogen. With such information for a guide, an approximation by analysis of the quantity of potash, phosphoric acid, and nitrogen contained in the soil of an orchard, together with the weight of produce and some allowance for weight of substances removed in leaves, prunings, &c., a rough estimate of balance in the soil might be obtained, and a fair idea be formed of the necessary substance or substances which require replenishing in the form of manure without waste. I know for a fact that great waste in the application of manure sometimes occurs, and, not unlikely, this is very frequently the case. For instance, an orchardist applies, say, superphosphate to his trees with considerable benefit. Others about the district hear of this, obtain superphosphate and apply without any benefit resulting. The vendor is blamed for the supposed rubbish; another brand is obtained and applied, and again without benefit. Simply because the soil did not require it; this substance being present already in sufficient abundance for present needs. Such mistakes occur through an ignorance that all soils even in the same neighbourhood may not be exactly alike.

In this necessarily incomplete paper, which has been written simply with a view to arouse discussion in the important matter of orchard manuring, it is not possible to give more than a very brief reference to the various kinds of manures easily obtainable in the colonies. First of all is farmyard manure, about which everybody knows something, but everyone does not know that it varies immensely in quality; indeed, this fact seems to be but little known or little considered. So long as it is farmyard or stable manure, it is thought to be all right, but I have very good grounds for thinking that it is not always all right. Good farmyard manure should consist of the solid and liquid excrements of domestic animals. These are generally more or less mixed with straw, leaves, or litter of some sort. The liquid portion is of considerable value, but unfortunately it is very frequently permitted to flow away, and, as a rule, in city stables the liquid is carefully washed away

and lost. The manure heap is generally exposed to the full influence of the weather, and no attempt is made to prevent the washing out by rains of valuable soluble substances. The bulky portion only is saved and applied to the soil. Good fresh farmyard manure should contain about 12 lb. of nitrogen, 6 to 7 lb. of phosphoric acid, and about 13 lb. of potash. Now, the very best time to apply this manure is whenever it can be obtained, no matter whether it be fresh or not; then there will be far less chance of losing the best parts of it. It takes a great deal of time and labour to turn and ferment properly a large heap of dung, and it seems to me very doubtful whether it is worth this expense for orchard purposes. This is all right enough for vegetables and plants which need immediately available supplies of food, but for fruit trees the case is somewhat different. I can speak with a good deal of confidence with respect to the application of this kind of manure to fruit trees, for I had a very long experience with it in an orchard which contained a remarkable variety of different kinds of fruit—stone fruits, oranges, lemons, apples, pears, grapes, figs, strawberries, bananas, and many others. The soil was a sandy loam (the washing of surrounding sandstone rocks) of rather poor quality. This orchard received an occasional liberal dressing of undecomposed farmyard manure, about every second year. This manure was forked in immediately after being spread. I have never yet seen an orchard producing better fruit.

As bearing upon farmyard manure, I beg to quote some particulars from a report made to the Department of Agriculture, United States, by Mr. H. J. Webber on "The Fertilisation of the Soil as affecting the Orange in Health and Disease." Mr. Webber says—"The elements which need to be supplied to fertilisation in most Florida orange groves, are nitrogen, potassium, and phosphorus, or, using the terms in which they are expressed in most analyses of fertilisers, ammonia, potash, and phosphoric acid. The application of lime would also prove of benefit to many groves. Probably no element of plant-food used in the fertilisation of orange groves should be more carefully considered, with respect both to form and quantity, than nitrogen. It is most costly and at the same time the most dangerous element to use, as excessive applications are liable to result in extensive dropping and splitting of the fruit, or in the production of the serious disease known as 'die-back.' * * * If the tree be starving from a lack of nitrogen, the foliage will become a very light-yellow and sparse, and the small limbs will die, as will also the large limbs in extreme cases. If the starvation is continued, no fertiliser being added, the tree will finally die back nearly to the ground, and probably die out entirely. The extreme symptoms of general starvation from lack of all elements are probably nearly the same. The nitrogen used in fertilisation is commonly derived from mineral or organic sources. Of the former, sulphate of ammonia and nitrate of soda are the forms most used; of the latter, muck, dried blood, blood and bone, cotton-seed meal, tankage, fish scrap, stable manure, &c, are the forms most commonly employed. * * * Barn manure is largely used by many growers, who hold that chemical manures are injurious to the plants. The benefits of barn manure to an orange grove are in serious question. The fruits produced by nitrogen from this source are usually large, coarse, thick-skinned, with abundant ray and of inferior flavour. If barn manure is used—and most growers have a limited supply and desire to use what they have—it should be spread over the grove lightly, so that each tree receives only a small amount. Where such manure is depended upon as the main element of fertilisation, liberal dressings of potash should be occasionally applied. This will tend to correct the evils of an overbalanced fertiliser."

Mr. Webber's report is thus summarised:—

(1) By a proper combination of the various elements used in fertilisation one can undoubtedly largely govern the quality and flavour of the fruit.

(2) To obtain a fruit with thin rind, use nitrogen from inorganic sources in moderate quantities, with considerable potash and lime.

(3) To sweeten the fruit, use sulphate of ammonia in considerable abundance, decreasing the amount of potash.

(4) To render the fruit more acid, increase the amount of potash and use nitrogen from organic sources.

(5) If it be desired to increase the size of the fruit, as is sometimes the case, apply a comparatively heavy dressing of nitrogen in some organic form, and slightly decrease the other elements. In the case of the Tangerine and mandarin, where a larger size is usually desired, a heavy dressing of nitrogen fertilisers would favour this end and is not objectionable unless carried to excess.

(6) Fertilisation has an important bearing on disease.
(7) "Die-back," a serious malady, is in all probability the result of over-feeding with nitrogenous manures from organic sources. These manures, if used at all, should be applied with great caution.
(8) Foot-rot, although not primarily due to improper methods of fertilisation, is no doubt considerably influenced by this cause.
(9) Insect diseases are also apparently influenced by the use of fertilisers, organic manures rendering the trees more liable to injury from this source than chemical fertilisers.

It is important to mention that the orange soils in Florida are "sandy and sterile."

Naturally, the experiments made by Mr. Webber are of very great value, and it would be well to have similar ones carried out in the orange-growing districts of our colonies. I believe that many differences in results would be found in the effects of manures to Australian soils. I may state that I have seen an orange orchard ruined by very heavy applications of organic manure from a slaughter-house; and I have seen stable manure applied to others with marked success. The soil in most instances being clay-loam over shale. I am inclined to think that, in the volcanic soils such as we have in the Richmond River district, New South Wales, and very similar soils in Queensland, such as that in the neighbourhood of Bundaberg, organic manures will be advantageous, particularly green manures such as the cow-pea. The farm manager, Mr. McKeown, at the Wollongbar Experimental Farm, Richmond River, has been making experiments with the cow-pea, especially for oranges, for some time past, and so far the very young trees, which have only been planted about three years, are thriving satisfactorily, and some of them have produced early and excellent fruit. For one thing, the soil there is very deficient in vegetable matter, and for another the cow-peas are grown as a green mulch. I merely mention this little experiment for what it is worth at present. I think a green summer mulch will prove very advantageous.

The mechanical condition of many of our soils would be greatly improved by the application of dung or the ploughing in of green crops, and their power of retaining moisture would be immensely increased. The effect also of these manures in liberating unavailable plant food during their decomposition will be found, I believe, to be very marked.

Another well-known and popular manure is bone meal, or bone dust as it is generally termed. This has been and is used in orchards without any mixture with other manures.

An analysis of good bone meal shows that it contains the following percentages of various substances:—

Moisture	... 8·38	
Organic matter ...	... 31·12	Containing nitrogen 4·06, equal to ammonia 4·93.
Lime phosphate ...	... 49·43	
Silica	... 1·51	
Calcium sulphate ...	... trace	(Gypsum)
Carbonate of lime ...	... 9·56	
	100·00	

Its chief value lies in the large percentage of phosphate of lime; but the nitrogen must also be considered of value.

It will be seen from this analysis that bone dust contains no potash, and as I have already indicated, potash plays a most important part in the life of fruit plants and in the formation of fruits, therefore if the soil of an orchard contains but little potash, and this orchard be manured year after year with bone dust alone, the little potash in the soil is likely to be very soon exhausted. I have seen many orchards manured year after year with bone dust alone, and the evil effects of such applications have been very apparent in course of time. I have used bone dust frequently for various purposes, on somewhat heavy soils, and frounde that it had a great tendency to consolidate and cake the soil, and I may state here that I found artificial or chemical manures generally to have this effect. I strongly advise anyone who uses bone dust to purchase it subject to analysis, for this manure can be very easily adulterated, and it is not profitable to purchase sand and other useless rubbish at the price of good bone dust.

Sulphate of ammonia is another manure well known in the colonies, and frequently used in orchards. Everyone who uses this chemical manure, should thoroughly understand that it is useful for one substance only, and that is nitrogen. He who uses it should also understand that after application the nitrogen soon becomes soluble

after it is converted into nitrates, and unless the nitrates can be made use of by plants quickly, heavy rains are likely to wash this valuable matter through the soil, and it is lost. Never apply nitrogenous manures, such as sulphate of ammonia or nitrate of soda, to an orchard before the trees are making growth in the spring, and then use it sparingly at a time.

If sulphate of ammonia be used alone, time after time, as is sometimes the case, without potash or phosphate of lime, the results are not unlikely to be disastrous to an orchard.

Nitrate of soda and nitrate of potash are so rarely used in the colonies, so far as I am aware, that I need not do more than say that the former is an extremely soluble nitrogenous manure, useful for dry soils in dry districts, where a nitrogenous chemical manure is needed, and that the latter is of value for potash as well as for nitrogen. This is the well-known saltpetre, and is probably too expensive to use.

Blood manure, dry, is frequently used in orchards. It is chiefly valuable for the nitrogen it contains, and should be applied when that substance is required. It is not so quick in its action as sulphate of ammonia.

Superphosphate of lime is, in the colonies, produced by dissolving bones in acid, and is of value for phosphate alone. The phosphate in bones when treated with sulphuric acid becomes far more soluble and available as food for plants than that contained in bone dust. Orchardists should bear in mind that superphospate will need the addition of nitrogen and potash to make a complete manure.

It is hardly necessary in this paper to refer to any other special manure except potash, which is of extreme importance to the orchardist, more so I think than is generally considered. The chief form in which it is used is that known as kainit, a substance obtained in immense quantity in Germany. This contains about 14 to 15 per cent. of potash. Kainit, as well as superphosphate, may be applied at any time to fruit trees, for they are not likely to be washed out by rains. The cheapest form in which potash can be obtained is in sulphate of potash, and it is far better than that obtained in kainit. These two manures can be obtained readily in Sydney, and I will just show the difference in value. Kainit, at present date (16th June, 1897), containing 12½ per cent. potash, is quoted at £4 10s. per ton in ton lots, or in three ton lots £4 5s.; and sulphate of potash, containing 50 per cent. potash, £14 for small parcels and £13 10s. in ton lots. I have already mentioned the very large percentage of potash extracted from the soil by all sorts of fruits. This shows how very necessary it is to provide a sufficient supply available for the requirements of fruit trees in full bearing. This subject calls for special attention, and deserves better treatment than I can possibly afford time to devote to it.

That very important substance, carbonate of lime, although familiar to everyone, is by no means used as much as it deserves to be. Its action in the soil is to neutralise acidity, break up and make mellow heavy soil, consolidate sandy soil, assists in decomposing vegetable matter; and also the formation of nitrates; and it also assists in making available for food substances (chiefly potash) otherwise unavailable for plants. Besides this it is of value, to some extent, as plant food. Great caution should be observed in applying lime, that it be not applied to land which has but recently been manured with nitrogenous manures, for by its action valuable ammonia would be set free and much of it lost. Its application to farmyard manure would have the same effect. Sulphate of lime or gypsum on the contrary will have the opposite effect and fix the ammonia; and for this purpose it is advantageous to apply it to fermenting dung.

At the orchard attached to the Hawkesbury Agricultural College, some little experiments have been made with manures with satisfactory results. The soil in this orchard is a poor-looking sand.

Mr. J. L. Thompson, the principal, has supplied me with the following particulars of the manuring:—

"The fruit trees, more particularly the stone fruits, were manured three years ago with a little bone dust, not more than 4 or 5 lb. per tree. It was spread round the trees at a distance from the stems corresponding with the extent of the branches from the trunks. It was lightly forked in. The result was almost magical, the growth being very strong and healthy. Some of the bone dust was in fine particles and some of larger size, the fine dust giving up its manurial elements at once, and the larger sizes yielding theirs by degrees. A little lime was also supplied; a small shovelful to each tree was also scattered round the trees last year, with very satisfactory results. A little kainit, containing a high percentage of potash, has also been applied experimentally at different times with the best possible results, our soil being deficient in that constituent which is so essential to the healthy development of all fruit trees." I may add to this that I sampled a good deal of the fruit—peaches chiefly—last season, and found it to be excellent.

There is one subject which I think may very fairly be considered when speaking about manuring, and that is the thinning of fruits. This is a matter so often neglected that its importance cannot be too frequently or too strongly hammered into all who grow fruit. The one great aim of every plant and of every creature is to prolong not so much its own life, as that of its species in its offspring. Fruit trees, as well as other plants, carry out this aim in the production of seeds, and in these seeds or fruits are concentrated the most important of the elements obtained by the plants from the soil. It therefore stands to reason that the greater the number of seeds or fruits that are matured, the larger the drain on the soil. The following valuable information given in the report of the Agricultural Experiment Station, California, throws much light on the amount of important soil ingredients contained in fruit, flesh of fruits, as well as those in the seeds, which are removed from the soil:—

A crop of—

	Lb.	Takes Potash. Lb.	Phosphoric Acid. Lb.	Nitrogen. Lb.
Prunes ...	30,000	79·70	15·95	44·40
Pits ...	1,635	2·06	2·80	10·30
Flesh ...	28,365	77·64	13·15	34·00
Apricots ...	30,000	84·98	21·38	68·70
Pits ...	1,740	1·36	5·36	15·00
Flesh ...	28,260	83·62	16·02	53·70
Oranges ...	20,000	42·28	10·60	36·60
Seeds ...	240	2·74	1·61	
Flesh and rind ...	19,760	39·54	8·99	

Any fruit-grower making use of this table could form a fairly approximate estimate annually of the annual amount of nitrogen, phosphoric acid, and potash removed by his crop of fruit.

If the fruit be thinned when first formed, the least chance of waste would occur. In a recent Californian fruit paper, I noticed a paragraph stating that some orange-grower was wise enough to dig into the soil around his orange trees all his poor, almost useless oranges, instead of sending them to market. The result was a great improvement in his trees.

Professor E. B. Voorhus, director of the New Jersey State Agricultural Experiment Station, gave, at a meeting of the Massachusetts Horticultural Society last year, particulars of some important experiments made in manuring fruit trees to ascertain "the comparative effect of an annual supply of what was deemed a sufficient quantity of the best forms of the three plant food elements—nitrogen, phosphoric acid, and potash—when used singly, and in various combinations; and of large applications of barnyard manure." The experiment included thirteen plots, each one-tenth of an acre in area, and containing thirteen trees. Each of the fertilised plots received an annual application of 150 lb. of nitrate of soda, 350 lb. of bone black superphosphate, or 130 lb. of muriate of potash per acre, thus furnishing an equivalent of 24 lb. of actual nitrogen or 56 lb. of "available" phosphoric acid, or 75 lb. of actual potash, on the three plots which received single elements, and combinations of these amounts of two of the elements on three other plots, and a combination of all, or a complete fertiliser on one plot. In addition, two plots were not manured; one received land plaster at the rate of 100 lb. per acre, and one barn-yard manure at the rate of 20 tons per acre, and one barn-yard manure at the rate of 10 tons and lime at the rate of 50 bushels per acre. Accurate records were kept each year of the health and vigour of the trees, and of the yield of the various plots. The soil—a clay loam with clay subsoil—was of medium natural fertility, responding readily to manures; its mechanical condition good, and fairly representative of the soil in the peach-growing sections of New Jersey.

At this point I will give detailed results and comparisons only in case of the plots without manure, with a complete manure, and with barnyard manure.

The average age of an orchard in our State is about eight years, during which period three full crops are usually secured. I therefore give the average yield in baskets for the average period of the life of the orchard for the whole period of the experiment and for the crop years.

1. The Yield without Manure.

	Bushels per Acre.
1884 to 1891 inclusive, 8 years, average per year ...	65·7
1884 „ 1893 „ 10 „ „ „ ...	60·3
1887 „ 1891 „ (5 crop years) „ ...	105·0
1887 „ 1893 „ (7 „ „) „ ...	86·2

II. The Yield with Complete Manure.

				Bushels per Acre.
1884 to 1891 inclusive,	8 years,	average per year	...	... 164·2
1884 „ 1893 „	10 „	„	...	... 183·4
1887 „ 1891 „	(5 crop years)	„	...	... 262·8
1887 „ 1893 „	(7 „ „)	„	...	... 262·0

III. The Yield with Barnyard Manure.

				Bushels per Acre.
1884 to 1891 inclusive,	8 years,	average per year	...	... 169·3
1884 „ 1893 „	10 „	„	...	... 194·7
1887 „ 1891 „	(5 year crop)	„	...	... 271·3
1887 „ 1893 „	(7 „ „)	„	...	... 276·8

IV. The Relative Yield in an Unfavourable Season.

	Bushels per Acre.
1889—Unmanured	... 10·9
1889—Fertilised	... 152·5
1889—Manured	... 162·5

The first point of importance and value observed is in reference to the number of crops that were secured. On the unmanured land the crops secured after eight years were so small as to materially reduce the average for the whole period; while for the manured land the average for the whole period was not only not reduced but very materially increased—that is, the crops secured on these, after the trees on the unmanured land had practically ceased to bear, were greater proportionally than those secured previous to that time. This was true both for the fertilised and manured land.

In the next place it shows that the yield was very materially increased by the use of manures, either in the form of artificial or natural supplies; and the differences in yield derived from these two forms are very slight, indicating that very much smaller amounts of actual plant food in quick acting forms were quite as useful as larger amounts of the less available forms in which the food exists in natural manure products.

For the ten years the fertilised plot received 240 lb. of nitrogen, 560 lb. of phosphoric acid, and 750 lb. of potash, while the yard manure plot received—assuming the average composition of yard manure—2,000 lb. of nitrogen, 2,000 lb. of phosphoric acid, and 1,000 lb. of potash; yet with eight times as much nitrogen, nearly four times as much phosphoric acid, and more than twice as much potash, the yield was but 113 baskets greater or 11 baskets per year. There was no actual difference in the size of the trees on the two plots; in both cases they were larger and for the most part healthy, and when the experiment was concluded it was not caused by the normal dying of the trees, but by the fact that the larger number of them were partially or wholly destroyed by a severe windstorm.

In the third place it is interesting to observe—and it is a point of great importance—the effect of an abundance of food in overcoming unfavourable weather or seasonable conditions. The year 1889 was extremely unfavourable, and the crop throughout the State was small. In this experiment the unmanured plot yielded at the rate of 10·9 baskets per acre, while the manured and fertilised plots both showed a yield exceeding 150 baskets per acre. The manure strengthened and stimulated the trees, and enabled them successfully to resist such conditions as were fatal to the crop on the unmanured land.

This point is one that is seldom considered in calculating the advantages to be derived from proper manuring, though it is of extreme value, since the expenses of cultivation, trimming, and interest on investment are quite as great in the one case as in the other.

Another experiment bearing on this point, recently reported by the Cornell Experiment Station, is also very instructive, as indicating the need of manures for fruit trees, not only in reference to the amount removed, but also in reference to the proportions of the essential constituents required.

This study shows that the plant food contained in twenty crops of apples of 15 bushels per tree and thirty-five trees per acre, and in the leaves for the same period, amounts in round numbers to 1,337 lb. of nitrogen, 310 lb. of phosphoric acid, and 1,895 lb. of potash. These amounts of plant food are compared with the amounts that would be removed by twenty years' continuous cropping with wheat, assuming an average yield of 15 bushels of wheat per acre, and 7 lb. of straw to 3 bushels of grain—viz., 66 lb. of nitrogen, 211 lb. of phosphoric acid, and 324 lb. of potash. By this

comparison it is shown that the twenty crops of apples remove more than twice as much nitrogen, half as much again of phosphoric acid, and nearly three times as much potash as the twenty crops of wheat."

Professor Bailey's remarks on fertilising peach orchards, which are quoted by Professor Voorhus, are well worth repeating:—"I believe that the keynote to the proper fertilising of peach orchards is potash and phosphoric acid, and not nitrogen. Ashes, muriate of potash, bone fertilisers—these are some of the money-makers for peach-trees. Tillage, with green manure crops at the end of the season, can be relied upon to furnish nitrogen in most instances. I do not wish to disparage the use of nitrogen, for even in bearing orchards a direct application may sometimes be necessary; but I desire to state what I believe to be a fundamental consideration in orchard culture, that nitrogen can easily be used to excess, and that it can generally be obtained by means of tillage and green manure, and that potash and phosphoric acid need to be annually applied to orchards of bearing age."

I will conclude this somewhat necessarily tedious paper by saying that I think I have shown, what I indicated at the beginning, that there is a great deal for a fruit-grower to learn if he expects to obtain the very best results from his orchard—that is, when it becomes necessary for him to apply manure; that he should make himself thoroughly acquainted with the requirements of his trees and the capabilities of his soil, or, rather, to put it more clearly, the amounts of the most important of the plant foods which his soil contains and which are likely to be or to become available for his plants. He should acquire a good knowledge of the various special manures obtainable, and whether he will need to apply the most important either singly or together, and in what quantity.

There is a great field open to those who wish to make experiments in manuring; and my strong advice is, that everyone who grows fruit should make a few for himself and not be altogether guided by those made by his neighbours, for in all probability every orchard soil will be found to differ in some respects from every other orchard, even though merely a fence separates them.

I regret to say that in New South Wales but little manure is used of any kind compared with other countries and other Australian colonies even. I have reason to think that not more than 2,000 tons per annum are made use of, and this is a paltry amount in comparison with the area cultivated.

And I also deeply regret to say that nearly all our valuable manure productions are being drained away from the colony. New Zealand seems to be one of the greatest and wisest vultures in this respect. Other Australasian colonies come here for their phosphates, and send us back fruit in exchange. I congratulate them on their wisdom. Mauritius and Japan even are beginning to make large inroads on our blood and bones, and very shortly we shall be left without even a skeleton. I admire these colonies and countries for their foresight and sense in coming to New South Wales to obtain the cheap means for enriching themselves and their orchards; but at the same time I deeply regret that we are such fools in this colony as to permit our orchards and cultivated lands to become impoverished for the want of a little knowledge.

Growing Tomatoes on Stakes.

"In no section of country," writes the *American Agriculturist*, "is tomato culture reduced to a finer system than in Mississippi, where the early tomato crop follows fast on the Florida and Louisiana shipments. The Mississippi growers, owing to their location, early made a special study of the tomato plant and succeeded in the adoption of a system that enabled them to compete successfully with tomato-growers in Southern Florida and Southern Texas. So successful has been the Mississippi plan, that tomatoes are now grown in fields of over 100 acres. In the successful culture of the tomato, early maturity is all important, and the Mississippi grower raises his plants in a hotbed to a good, stocky size, and early in spring sets them out in the field, being particularly careful to take up a comparatively large block of earth with each plant, so that the growth is scarcely checked. Very soon he goes through and pinches out all axiliary suckers or sprouts. This forces the sap into the main stalk, and induces early fruiting. Some suckers may come from beneath the surface of the ground. These must also be pulled off, leaving a single stem. As soon as the planting is completed, a split stake, 5 feet in length, is firmly set at each plant, and, about the time the fruit is setting, each plant is tied with common cord, which has previously been wound around a bit of plank, and cut 13 to 14 inches in length. Each string is then tied firmly around the stake and loosely about the stem of the plant, so as not to interfere with its growth, being careful, also, not to allow the fruit to cluster so as to rub the stake. The sprouts or axillary suckers will grow very rapidly, and must be kept constantly pinched off. Three tyings are usually necessary up to the time when five good clusters of fruit have set. When these aggregate 20 or 25 tomatoes, the top is pinched off, and the whole strength of the plants is centred in the production of firm, bright, smooth tomatoes, of good and uniform size. Care is taken to leave a leaf stem above the top cluster for shade. Pinching back the suckers tends to increase the size of the leaves, making ample shade for the fruit. The objection that pruning leaves the fruit too much exposed, and causes sunburn, is not borne out in practice. By persistently checking all superfluous growth, both plant food and moisture are economised, and the size of the fruit is kept up to good standard. An additional advantage is that the well-pruned plants can be set closer, and the danger from rot is much reduced. The Mississippi planter pinches back the stem, as stated, because of his comparatively short shipping season, for the plant contains all it can profitably mature. For a garden crop, or one on rich land, the stalks can be trained to 5-foot stakes, or as high as desired. Growers usually hesitate to plant tomatoes on rich land, fearing a rank growth with but little fruit; but by the system of pruning as practised in Mississippi, the plant is forced into fruiting. This system is also of great value in small gardens where the space is limited."

Botany.

PLANTS REPUTED POISONOUS TO STOCK.

By F. MANSON BAILEY, F.L.S.,
Colonial Botanist.

In the present *Journal* two reputed poisonous plants are illustrated, and it is intended to follow up with others, as such are forwarded, like those figured, for identification, &c. I do not hold myself anywise responsible for the poisonous character so frequently given to these and others of our indigenous plants. The plants brought under notice from time to time will be those *reputed* as poisonous to stock, of which probably only a very few contain any deleterious principle at all. For instance, I remember that in the early days of South Australia, the two plants now under notice, or at least one of them and a closely allied species of the other, were amongst the most common and abundant of the plants of the Adelaide plains, and yet no harm was ever heard of as accruing to the stock which ate them with the grass and other herbage. Yet now we find persons in South Australia, and from there to Queensland, professing a belief in the poisonous properties of the two species of *Bulbine*, if not in *Calostemma*. With a view to arriving at the truth of the various statements regarding the poisonous or deleterious properties of the so-called "poison plant," I would suggest that experiments be carried out at the Queensland Agricultural College. The cost would be small, and the advantage to the country great. Only a small plot of each plant would be required; stock for experimenting upon could be obtained easily and cheaply in the district, and the College staff have all the intelligence for successfully carrying out the work.

Calostemma luteum, Sims. (see Plate), which has lately been sent from O K Station, Condamine, where it was suspected of poisoning a number of sheep, belongs to the order Amaryllideæ. So far as my memory serves me, this is the first time the plant has been accused of deleterious properties, and, even supposing it to possess such, the small amount of foliage formed by each bulb would prevent its doing any considerable amount of harm. The genus contains from three to five species, according to the views taken by different botanists. The flowers of the various kinds are very similar in form, but differ in colour from white to yellow and from purple to pink.

The following Liliaceous plants, *Bulbine bulbosa*, Haw. (see Plate), and *B. semibarbata*, Haw., are the Australian representatives of the genus, and both have received the same vernacular name—Native Onion or Native Leek; sometimes a distinction is made by designating the latter, which forms a smaller plant, as the Lesser Onion or Leek; both are met with in Southern Queensland, and the effect on stock is said to be similar. The principal distinction made by the botanist may be given in the words of Bentham, Fl. Austr. vii., 34, viz.:—

Perianth usually about ½-inch long or more. All the filaments bearded. Root often tuberous ... ... *B. bulbosa*.

Perianth about ¼-inch. Only the 3 inner filaments bearded. No tuber to the root ... ... *B. semibarbata*.

CALOSTEMMA LUTEUM

BULBINE BULBOSA

The leaves of both are of a deep-green colour, and the flowers bright-yellow. The effects of *B. bulbosa*, according to Sheep Inspector Hutchison, on cattle, sheep, and horses, are almost the same—continually lying down, rolling, terribly scoured, mucous discharge from the nose of a green and yellowish colour. Cattle survive the longest; sheep take some three days, and horses will linger for a week. To a pony poisoned by this weed, Mr. Hutchison gave 10 drops of laudanum in half-a-bottle of castor oil three times during the day; also applied three bran poultices on the loins. This appeared to give immediate relief, as previously he could hardly use his hind legs, and was lying down with his head towards his sides biting his flanks. His urine was thick and green till after the second dose, when it appeared in its natural state; his eyes sunken, and flanks shaking. (From Bailey and Gordon's "Plants Reputed Poisonous and Injurious to Stock, 1887.") Other writers give a somewhat similar account of the effects they suppose to occur from animals eating Native Onion.

Economic Botany.

No. 2.

COCA (*ERYTHROXYLON COCA*, Lam.)

By J. F. BAILEY.

Derivation.—From *erythros*, the Greek for red, and *xylon*, wood; some of the species having red wood. *Coca* is the native name of the plant, and means the "tree" or "plant" *par excellence.*

Description.—The plant belongs to the Flax family (Lineæ), and forms a small bushy much-branched shrub 4 to 6 feet or more high, with a purplish-brown wrinkled bark. Leaves closely placed, alternate, shortly stalked, 1 to 2 inches long, lanceolate or oval, rather attenuated towards the base, entire, rather thin, bright-green above, paler beneath, glabrous, midrib prominent, and on each side a nerve running from the base to the apex, lateral veins numerous. Stalk of leaf about ¼-inch long, stipules small, closely pressed to the stem, triangular, acute. Flowers small, white, on slender stalks, several together in the axils of the leaves. Fruit a small indehiscent red drupe, about ½-inch long, smooth, but furrowed when dry. (*Vide* Plate.)

Cultivation.—The Coca is cultivated very largely in the Andes of Peru, Bolivia, Columbia (especially in the very moist mild climate met with at from 2,000 to 5,000 feet above sea-level), parts of Brazil, and many other countries of South America. The plants are propagated from seed, which should be sown, as soon after gathering as possible (as, like many other seeds in this climate, they do not keep well), in a plantation set apart for the purpose. When the seedlings are about 6 inches high they may be transplanted to their permanent situations. The remarks *re* shading given last month about papaws apply equally to these plants. In South America the plantations (called "cocals") are generally formed on the steep warm declivities of the mountains, the original forest growth being cleared for the purpose. The plants when young will not stand frost or cold winds; therefore should not be planted where they are subject to such. A plant of Coca may be seen growing on the side of the hill at the rear of the coffee plantation in the Brisbane Botanic Gardens, where it has been growing for the past thirteen years.

Uses.—The parts used are the leaves; and the extraordinary virtues ascribed to them by the Indians of South America, who have used them from the earliest periods, have excited the attention of numerous travellers, &c. Poeppig states that miners chewing it every three hours, with a handful of maize, will perform very severe work for twelve hours, and that an Indian runner will carry a load of 1 cwt. for ten leagues over rough roads in eight hours by its aid alone. Stevenson, who for twenty years resided in Peru, and was secretary to the Governor of Quito (capital of Ecuador), states that "the natives in the mines, and travelling, derive such sustenance from chewing the leaves that they frequently take no food for four or five days, though constantly working, and that they had told him that with a good supply of Coca they felt neither hunger, thirst, nor fatigue, and that without inconvenience or injury they could remain eight or ten days without sleep." Most writers, however, agree that when Coca is taken in excess it produces highly injurious effects, like the immoderate consumption of other stimulants or narcotics, such as fermented liquors, tobacco, opium, &c.

ERYTHROXYLON COCA, LAM.

Coca has been praised as a nervine and muscular tonic, preventing waste of tissue, appeasing hunger and thirst, relieving fatigue, aiding free respiration, and as being useful in various diseases of the digestive and respiratory organs. It is said to be specially useful in many forms of asthma, chronic bronchitis, obstinate cough, phthisis, and general debility; in gastric derangements, owing to its slight astringency, it seems to give more tone to the stomach than the mere anœsthetic action of the cocaine it contains would produce locally; it is recommended for indigestion, gastralgia, gastrodynia, nausea, sickness, distaste for food; is given to relieve pain, vomiting, or discomfort caused by excess in either eating or drinking, and as a cure for opium or alcohol craving. In using it for this in America, it is said in some cases to have produced "Coca craving."

Coca is also said to cause mental exhilaration, and has been used in melancholia, in cases of inordinate hunger or thirst such as occur in some forms of diabetes, and in cases of generative debility. Locally, a solution of the extract in water has been used as a pigment in irritated, inflamed, and granular conditions of the larynx and pharynx.

The pastils have been used similarly for loss of voice due to weakness or relaxation of the vocal cords. Topically, these preparations act as astringent sedatives without deranging the stomach. Externally, Coca may be made into poultices, or a plaster made with the extract combined with resin or soap plaster may be applied for rheumatism, lumbago, &c. The leaves are also sometimes smoked to relieve asthma.—*Martindale and Westcott, Extra Pharmacopœia.*

Cocaine.—The active principle contained in the leaves is an alkaloid called "cocaine," and is largely used in medicine, surgery, &c.

For ophthalmic surgery, cocaine is in general use, and its application considered most satisfactory. It is also of great value in nose, ear, and throat operations. Good Coca leaves yield 0·5 per cent. or more of cocaine, but the average is less, and if fermented often *nil.* The London market price of cocaine in July (1897) was 9s. 3d. to 9s. 6d. per oz.

Collection, Preparation, &c.—Great care must be taken in the gathering, drying, and preservation of Coca, as its activity and value depend in a great measure on its mode of preparation. The leaves should be gathered as soon as they have arrived at maturity, at which period they are bright-green on the upper surface and yellowish-green on their under surface, and have an agreeable and somewhat aromatic odour. The leaves are gathered separately and carefully by hand with the twofold object of preventing them being crushed or bruised in the process; and also so as not to injure the young leaf-buds which are left behind for the purpose of obtaining a second crop of leaves. They are then spread out and dried slowly in the sun. This operation must be performed with great care, for, if the leaves be dried too rapidly, they lose their odour and green colour; and if stored away before they are thoroughly dried their colour is also changed, and they acquire a disagreeable odour and taste.

Commercial Coca either consists of the leaves more or less pressed together in compact masses, or of the leaves in a loose state. In either case the leaves are not curved or rolled in any degree, but perfectly flat. The properties in the leaves are injured by transportation, and often by keeping; therefore they should be packed in tin-lined cases.—*B. and T. Med. Plants.*

Coffee-growing in the Mackay District.

By D. BUCHANAN,
Manager of the State Nursery, Mackay.

It should be a matter of congratulation to all interested in the progress of Queensland agriculture, to see and know the efforts that are being made to establish the coffee industry in this district; the number of people that have come here to ask for information and to see for themselves afford proof that coffee-growing is to become an item in the farmers' programme, if it does not eventually become a rival of cane-growing. I know that objections can be urged against entering into the industry: The *Hemelia* may find its way here—the flying foxes may eat the cherries—the drought may kill the crop—the price may fall, &c., &c.; but all other branches of both horticulture and agriculture are subject to the same calamities and are likely to continue to be so. Notwithstanding the wail of the pessimist, however, the idea and the work are progressing. Not that there is as yet any large breadth of coffee planted, but preparations are being made, and the demand for seed, by even the intending small growers, has been far beyond the supply available at present at the nursery. Many people failed last year to get the seed to grow, some through their own fault in the sowing, although with all parcels sent from here this season full instructions have been supplied, which, if carried out, must result in success.

Some months ago several people expressed their fear that as coffee-growing required a certain amount of scientific knowledge, the ordinary farmer or cane-planter would not succeed, but that hallucination, I think, is now pretty well corrected. I have drawn my conclusions from the fact of seeing, for several years, isolated coffee bushes growing at their own sweet will, getting no assistance in any way, but yet perfectly healthy and bearing large crops of fruit. Seeing the health and vigour of these trees convinced me that the climate and soil of the Mackay district were eminently suitable for coffee cultivation, and thanks are due to Mr. Dansey and his company for taking the initiative in this direction. I am quite convinced that there are few farmers in this district who have not a few acres of their farms quite suitable for coffee-growing, and the cane-farmer is just the man who can make a beginning in coffee-growing. The man who has no capital cannot do it. He has three years to wait before he can get any returns, but the cane-farmer, who has a crop to go to the mill, has got money to lift. It may be possible that not much of it is his own, but still he has something to go on with, and, when the year arrives that his coffee yields half a crop, it will considerably add to his income. There is a prevailing opinion that a large amount of labour is required in coffee-planting, but this is a mistake—it is but a tithe of the labour necessary for cane-growing. If the planting is carefully (diagonally) done, so that a horse can be employed in two or three directions in the rows, there will be very little hoe work required, whilst horses may be worked amongst the trees for four or five years, but where the coffee-grower is also growing cane it will pay well to cover the whole of the coffee ground with cane trash. This will keep the weeds down for twelve months, and thus neither horse nor hoe will be required; this plan will not only save labour, but it will keep the moisture in the ground; and as the trash rots, it forms a manure for the benefit of the plants. To facilitate this work, the space between every fourth and fifth row ought to be wider than the rest, to allow of the passage of a cart for several years to draw the trash in; and as the latter can be put close up to the stem of the coffee plant, the lower branches lie upon it, and the cherries are thus kept clean. A farmer came in the other day and remarked: "Don't you cut these bottom branches

off?" My reply was: "No, I can see no reason for doing so. As long as I have trash below them to keep the fruit clean, I should not think of cutting them off; these branches were covered with as many cherries as branches higher up." So long as the roots are capable of supporting the crop, I say, give the bushes as much bearing surface as possible. If the bush is kept in the form of a cone, the lower branches will be healthy; but if the top is allowed to overhang the lower portion, then these lower branches will be of no use. Where the land is sheltered, it is better to keep the plants to one stem, as they are much easier pruned and kept in order. I started on this principle, but had to give it up and allow the suckers to grow close to the ground to strengthen the base and induce roots, in order to keep the trees from being blown out of the ground. Many of these suckers are now being removed, as they have accomplished the object of making plenty of root and a strong base for the stem. More of these strong suckers would have been removed at this pruning, but it would have been at the sacrifice of next year's crop, which must be guarded against, for, large as the demand has been for seed this season, I anticipate it will be still greater next year; and although the present appearance of the trees points to a heavy crop, the limited number of trees will cause the supply of seed to fall short of our requirements. I have been confronted with the argument that coffee-picking in this neighbourhood would be impossible for want of labour.* I have not yet shared this fear. Picking of the coffee crop will be nearly over before cane-crushing begins, and there are always a number of men who, whilst waiting for the crushing, will find the coffee-field a favourable place to spend their waiting time, and where they can earn a good wage. Furthermore, as boys and girls can pick as much as and, perhaps, even more than a man, and as coffee-picking can be so conveniently done by contract, there will not be much difficulty. I do not think that the kanaka will ever make a coffee-picker, for he will not be any quicker with his finger and thumb than he will when his whole body has to be brought into action, as is the case in cane-cutting. One great advantage coffee-growing has over cane-growing lies in the fact that the cane-grower has to cut, load, and cart (all laborious work) his cane to the mill or railway siding, and then he gets from 10s. to 14s. per ton, and if he is not within three or four miles of his place of delivery, then there is very little left for him over expenses; but the coffee-grower can afford to settle fifty or more miles from his market, and in a three or four days' journey he can bring to that market £100 worth of his goods, and even far more if he has it to bring. It is sometimes advanced that Queensland cannot compete with countries in coffee-growing where labour is so cheap. Well, there is some show of reason in that, but facts are against the argument. The West Indian Islands have had labour cheap enough, but the sugar industry has just about collapsed, and whether the Royal Commission will see a way out of the trouble remains to be seen. One of the items brought before the Commissioners by a native labourer was the wretched wage they had to work for; if this "wretched wage" was an absolute necessity, sugar-growing in the West Indian Islands would have been a success. The Mackay district coffee-planter has two great advantages on his side—soil and climate. These are evidently well adapted for the purpose, and pluck and perseverance will do much to counterbalance the big-wage bogey. If the wage difficulty were an insuperable obstacle, then the Mackay people may give up all idea of coffee-growing; but I do not think it will.

In my next paper I will deal with sowing the seed, wherein so many have failed, and with other details connected with this promising industry.

* The same fear was expressed in years gone by, when cotton-growing was first initiated in this colony. It would, it was said, be impossible to find sufficient labourers at picking season—wages were too high. The results proved the fallacy of this. No cotton ever remained unpicked in the fields. Men, women, and children made good wages at 1s. 4d. to 1s. 6d. per cwt. of seed-cotton, and there was no lack of pickers. The first shipment of cotton to England was in 1854, and during the American Civil War, when the population was far less than it is now, thousands of bales of cotton were sent home, yielding a large profit to farmers, pickers, and proprietors of ginning establishments. We have every faith in the future of coffee-growing in the North.—Ed. *Q.A.J.*

Preventive Inoculation for Tick Fever.

By C. J. POUND, F.R.M.S.,
Director of Stock Institute.

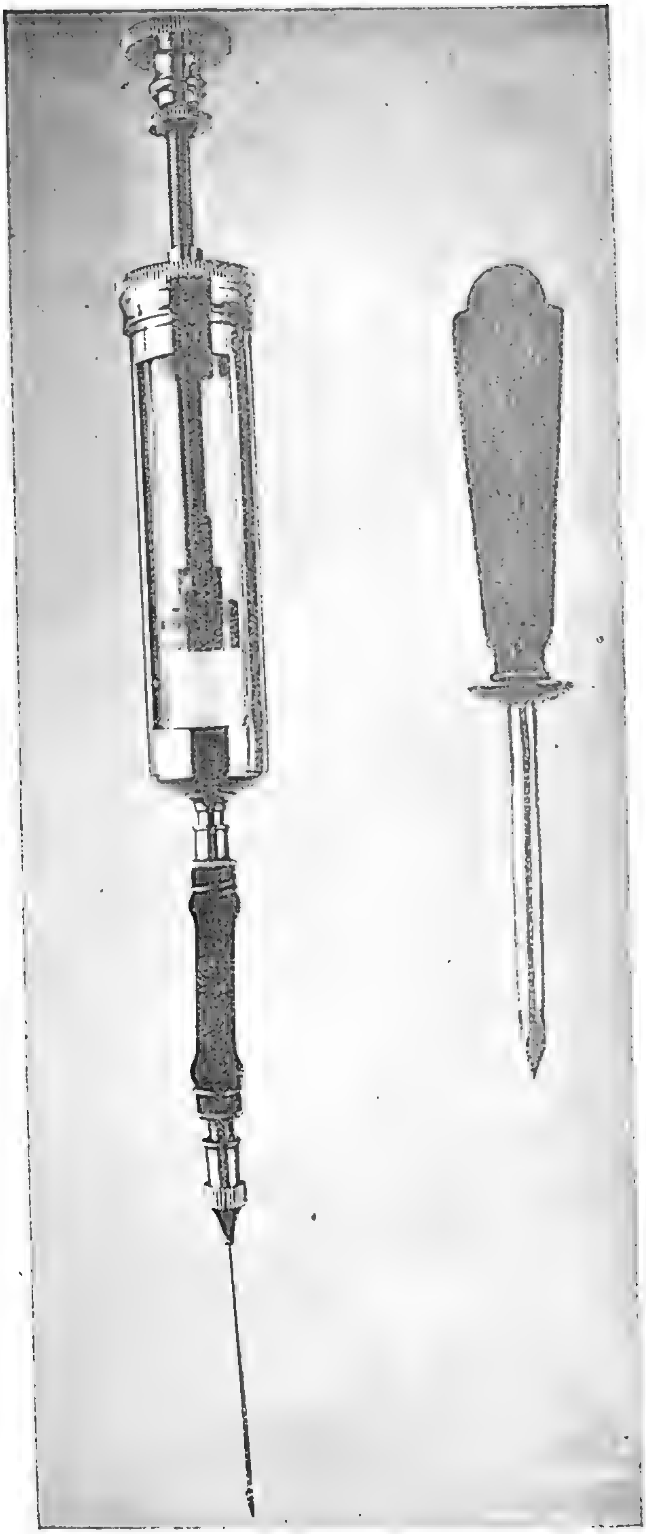
By carefully considering the following directions, anyone accustomed to work among cattle may be able to perform the necessary operations without personal instructions. The operator must be provided with the following necessary appliances:—

1. Trocar with canula attached. The latter should be $\frac{1}{8}$-inch in diameter.
2. Syringe to hold 10 c.c., strong, and well fitted with extra needles.
3. Two wide-mouth glass jars, to hold about 1 pint each.
4. Two small wide-mouth jars, to hold about 2 ounces each.
5. Twenty to thirty fowl-wing feathers, previously washed in weak carbolic solution, then clean water, and finally dried in the sun.
6. Several pieces of clean linen or calico.

The most suitable immune animal to take blood from, is a calf between six and twelve months old. The reason why young animals are preferred is that they are easily handled and managed, and in inoculating blood from a calf there is very little risk of introducing tuberculosis, which is seldom to be found in calves.

The best way of operating is to throw the calf on its left side, place a strap around the base of its neck so as to compress the right jugular vein, which in course of a few minutes will become very much dilated or swollen by the blood coming from the animal's head. A safe precaution will be to flatten the hair on the skin where the trocar is to be used with a little solution, 1 to 20 of carbolic acid: this removes any danger of introducing foreign matter into the vein of the animal which might produce blood-poisoning or an abscess under the skin.

The calf is lying on the ground with its feet from the operator, who lays his left hand on the neck and gently holds the swollen vein between the fore-finger and the thumb close up to the strap to prevent the vein from shifting laterally. He then takes the trocar in his right hand, and with it in a vertical position steadily pierces the skin into the vein. Immediately the point is through the wall of the blood-vessel, the instrument is held in a slanting position and gently pressed further into the distended vein. He then withdraws the trocar with the right hand, the while holding the sheath or canula with his left, and keeping it well into the blood-vessel. If the vein has been successfully pierced, blood will flow copiously. If it does not flow, the operator returns the trocar into the sheath and gently withdraws both of them a very slight distance but not out of the wound, because at the first insertion the trocar may have been forced through the vein or on one side of it, which often happens in the case of young thick-necked bulls. However, as soon as the blood flows freely on the withdrawal of the trocar, it is caught in a perfectly clean wide-mouthed bottle. From an animal six months old, half-a-pint of blood may be taken, and as much as a pint from a yearling. In the summer time, when the flies are plentiful, a little tar should be placed on the wound before the calf is released. As soon as the requisite amount of blood is drawn, it should be well stirred for about five minutes with a whisk, formed of half-a-dozen wing feathers from a duck or fowl. At the end of that time, the whisk, when lifted out, will be



Syringe and Trocar, used in the process of Inoculation.

INSERTING THE TROCAR.

DRAWING OFF THE BLOOD.

INJECTING THE SERUM INTO A HEALTHY YOUNG BULL.

found to be covered with stringy-like fibrinous matter, white and blood-stained. This is the fibrin, and its removal prevents the blood thickening, clotting, or coagulating. The process of whisking and removing the fibrin is known as defibrination. Defibrinated blood is that which has been so treated. The blood is afterwards strained through a piece of clean linen or calico into another clean bottle, and is ready for use. Allowing 5 c.c., which is equal to one teaspoonful, for one bullock, one pint of defibrinated blood would be adequate to inoculate 120 bullocks. No more blood should be taken from an animal and defibrinated than can be used in four hours. When kept longer the blood is apt to become contaminated with various kinds of bacteria which are floating about in the atmosphere of the stockyard or shed, or other foreign matter, which, injected into an animal, might either produce blood-poisoning or an abscess.

It is advisable that, as dust is certain to arise in stockyards, the mouth of the bottle containing the defibrinated blood should be kept covered with a piece of clean linen or calico, and it should be kept in a cool shady place. To minimise, as far as possible, the risk of contamination, the following precaution may be adopted:—

"The operator puts about 2 oz. of blood from the stock bottle into a small wide-mouthed bottle, which is also covered with clean linen or calico. This smaller bottle is for actual work of inoculation, and should be filled up as required."

Inoculation should be performed without delay. The animals to be inoculated should be placed in a crush as many as possible at a time, so that the work may be carried on quickly. The syringe now comes into use, and every attention should be paid to its cleanliness. In order to make the piston-rod work freely in the cylinder, it is necessary to apply a little vaseline to the leather or rubber washers. In the latest form of syringe, there is a very ingenious device for tightening or slackening the washers of the piston-rod without removing the latter from the cylinder.

A word or two of description here may be useful. It is in principle like a squirt or garden syringe, but should have the very latest improvements. On the piston-rods of some kinds, and on the glass cylinders of others, will be noticed a row of figures above a transverse line. The space between each line indicated is a cubic centimetre—that is to say, when the piston-rod has been withdrawn till the figure 3 is visible, then there are 3 cubic centimetres of space in the cylinder of the syringe. As 5 cubic centimetres are necessary for the inoculation of an animal, the needle should be thrust through the linen cover into the small bottle of blood, and the piston-rod of the syringe withdrawn till the figure 5 appears outside the cylinder. With the syringe there is usually supplied one or more hollow needles, each having a metal socket which fits on to the nipple-point of the metal protector of the glass cylinder.

As the animals shrink and move suddenly from the needle when thrust into them, it is very apt to get broken, and the use of a very simple contrivance is recommended to save the needles. This consists of about 3 inches of thick walled India-rubber tube, one end of which fits close on the nipple of the syringe, while the other makes the connection by going over the socket of the needle, thus giving free play to the syringe when blood is being injected into an animal, and the operator has more freedom in using it. The tubing should be $\frac{3}{8}$-inch in diameter, and the walls so thick that the aperture is only $\frac{1}{16}$-inch in diameter. Thick tubing does not kink and stop the flow of blood. The instrument, having been made ready by fitting on the tube and needle, is charged with blood by plunging the needle through the cloth into the little bottle and the withdrawal of the piston. Only one dose at a time should be used. A little fold of loose skin behind the shoulder of the animal to be inoculated is lifted from the ribs with the left hand. The needle is then plunged obliquely about an inch through the skin into the loose or subcutaneous tissue, thereafter the piston is pressed slowly down, and the blood forced into

the animal. Although this part of the body is best to operate on, it is not essential that the inoculation should take place there. It may be accomplished by transfusion of blood into almost any part of the body. For instance, if there were difficulty in getting at the shoulder, the blood might be injected into a more accessible part, as the flank or rump. An animal ought not to be inoculated in the tail, the reasons being—in the first place, the tail is exceedingly sensitive, and the needle is more apt to get broken in it than in any other portion of the body; and in the second place, it is almost impossible to introduce the required amount of blood.

The blood having been transferred from the syringe to the beast, the operation is complete. It is not necessary to take the temperatures of the animals afterwards, as, if proper blood is used, the inoculation never fails.

When using the trocar and syringe, care must be taken to have them properly clean. They should be well washed in warm water which has been previously boiled, then rinsed in water containing a little carbolic acid. The washers of the piston should be carefully cleansed after use, and rubbed with vaseline to prevent the leather or rubber becoming hard and deteriorating. The needle also should be carefully washed and dried, and anointed inside and out with a little vaseline.

Note.—In inoculating large herds of wild cattle, the following addition to the syringe has been found to be most desirable:—A three-way tap is brought into use, the first aperture of which connects with the nozzle of the syringe; to the second is attached about 10 inches of India-rubber tubing, the opposite end of which is kept constantly at the bottom of the (sodawater) bottle of blood, which is fastened to the belt of the operator in charge of the syringe; and to the third aperture of the three-way tap is attached a piece of thick-walled rubber tubing about 8 or 10 feet in length, and to the other end of this tubing is fixed the inoculating needle. (See Figs. 1 and 2.)

The use of the three-way tap and long tubing absolutely prevents the blood from becoming contaminated.

It is necessary before operating to expel the air from the tubing.

If the three-way tap is not procurable, it is advisable to connect the needle to the syringe direct with 10 feet of tubing.

The trocar and syringe can be obtained from Carl Zoellar and Company, Courier Buildings, Brisbane; or L. Bruck, Castlereagh street, Sydney.

Fig. 2.

Fig. 1.

INOCULATING WILD CATTLE.

Entomology.

LADYBIRDS (*VEDALIA CARDINALIS*).

Nature has two articles on the subject of the introduction of beneficial insects to countries in which fruit trees and other vegetation are affected by insect pests, which are worthy of attentive perusal, especially by orchardists.

The first is from notes on the result of introducing predatory and parasitic insects into the Hawaiian Islands for beneficial purposes, communicated by the secretary of the committee appointed by the Royal Society and British Association for investigating the fauna of those islands. The writer says:—"Few countries have been more plagued by the importation of insect pests than the Hawaiian Islands; in none have such extraordinary results followed the introduction of beneficial species to destroy them. By far the most conspicuous of the former class, and hitherto the most injurious, have been the Scale Insects. The number of species of this group which have been spread over the islands is remarkable, and no less so, the enormous multiplication of individuals of many or of most of these species. The first importation of Coccinellidæ to destroy these hordes was made in 1890, when *Vedalia cardinalis*, Muls., a native of Australia, was sent over by Mr. Albert Koebele. At that time many trees were in a deplorable condition from the attacks of *Icerya*, monkey pod trees being particularly badly infested—so much so that they were being largely cut down as the only resource. The *Vedalia* was a complete success; it became perfectly naturalised, increasing prodigiously for a time; it practically cleared the trees, and then, as the *Icerya* became comparatively scarce, decreased in numbers; while it is evident that the number of the scale and its destroyers has arrived at a fixed proportion. Previous to its introduction into the islands, the same Ladybird had done excellent service in the fruit orchards of Lower California. One of the most useful Ladybirds has been *Coccinella repanda* (from Ceylon, Australia, China, &c.), which feeds on *Aphides*. The services of this species cannot be overrated. On Kauai recently, the cane was so much attacked by the *Aphides* as to cause considerable alarm. On visiting the locality, the *Coccinella* was found to be already present, breeding in such numbers as to leave little doubt that the plants would soon be clear. On the same island, on another occasion, I saw the fruit trees (especially oranges and limes), in a beautiful garden, in a most deplorable condition from the attacks of Aphis and Scales. Very few Ladybirds could be found after a careful search. The owner was for spraying the trees, but, seeing that their condition could not be worse, I advised him to wait and give the beetles a chance. In a few weeks these were swarming, and when I returned, after six months, the infested trees were all in perfect condition, full of fruit and flower. No less useful than the preceding is the *Cryptolæmus* (*C. montrouzieri*) introduced from Australia, and thoroughly naturalised.* It attacks the injurious species of *Pulvinaria*. When I visited the Kona district of Hawaii in 1892, many of the trees were literally festooned with masses of these pests, and appeared on the point of being totally destroyed. In 1894, the Ladybirds were sent over there, and very soon had entirely changed the condition of things. The attacked trees speedily recovered. To show the vast increase of this species of Ladybird, I may state

* The predaceous Ladybird (*Cryptolœmus montrouzieri*) was first made known to the scientific world by Mr. Henry Tryon, Entomologist to the Department of Agriculture, Queensland, in a paper issued by that Department; and its useful work in Hawaii is so pronounced as to show that Mr. Tryon was fully justified in entertaining the opinion regarding its important services that he formerly expressed.—Ed. *Q.A.J.*

that in June of the present year (1897) many large trees in the city of Honolulu had several square feet of their bark entirely hidden by the larvæ, which formed great white masses, presenting such an extraordinary appearance that I much regretted not having been able to obtain photographs of some of the trees. Other introductions were *Orcus chalybeus* from Australia, feeding on *Lecanium*, *Pulvinaria*, *Diaspis*, &c.; *Rhizobius ventralis* from China and Ceylon attacks that very abundant scale, *Lecanium Longum*. *Chilocorus circumdatus*, introduced from China and Ceylon, breeds freely on scales in Honolulu. Trees literally covered with *Mytilaspis* were entirely cleaned. Even the dead, dry scales were turned over in the search for food. Before the introduction of the species above mentioned, the only Hawaiian Coccinellidæ were a few species (probably endemic) of *Scymnus* and *C. abdominalis*; the latter no doubt accidentally imported from Australia many years ago. Unfortunately, this species is attacked by a hymenopterous parasite, a *Braconid* (*Centistes americana*, Riley), which might interfere with the splendid work of *C. repanda*. The presence of this parasite is the more to be deplored, as such care was taken to exclude parasitised specimens when the introductions were made. This was very necessary, as the Ladybirds seem very liable to the attacks of parasitic Hymenoptera, especially the Australian species."

Further information is given on the subject by Mr. C. L. Morlatt, in the "Year Book of the United States Department of Agriculture." He describes the various methods of combating the ravages of injurious insects in California, and says that the possibility of control of insects, by introducing and fostering their natural enemies, has been thoroughly tested. A very notable instance of the entire eradication of the White Scale insect by the introduction from Australia of its Ladybird enemy, *Vedalia cardinalis*, demonstrated the possibilities in this direction in the most striking way. This one experiment saved the State its citrus industry, and gave the greatest confidence in many quarters in this means of controlling insects on a much larger scale. It led the State of California in 1891 to grant $5,000 for the purpose of sending an expert to Australia, New Zealand, and the adjacent colonies to collect, and import into this State, parasitic and predaceous insects. Mr. Albert Koebele, who had previously been instrumental in introducing *Vedalia cardinalis*, was selected for the work. The chief object was to obtain predaceous insects which might exterminate the Black Scale, the Red Scale, and the San José Scale. Mr. Koebele's mission lasted upwards of a year, and during this time he imported into California some 60,000 specimens, representing very many species, chiefly Ladybirds. Five or six of these species took hold well from the start, and two or three of them are still represented abundantly in the orchards of California, others having practically disappeared, but the important ones remaining include the very efficient predatory enemy of the Black Scale, in the *Rhizobius ventralis*, and two much similar species, *R. debilis* and *R. toowoombæ*, which attack the Black Scale, and also the Red Scale, and San José Scale to a less extent. *R. ventralis* was easily colonised, and during the last three years has been distributed in enormous numbers to different parts of the State, 300,000 to 400,000 having been colonised in Lower California alone. This beetle has been far the most useful of the recent importations, and has already done much good; in several instances, it has effected the entire reduction of Black Scale in badly infested orchards. The disappearance of the scale may, in some cases, be due to other natural causes, but there seems to be no doubt that the chief credit belongs to the Ladybird. Once the Ladybirds have established themselves in sufficient numbers, it seems best not to spray or fumigate the trees, as these treatments are very prejudicial to the multiplication of this beneficial beetle.

Pisciculture.

FISH CULTURE AND ACCLIMATISATION.

By D. O'CONNOR.

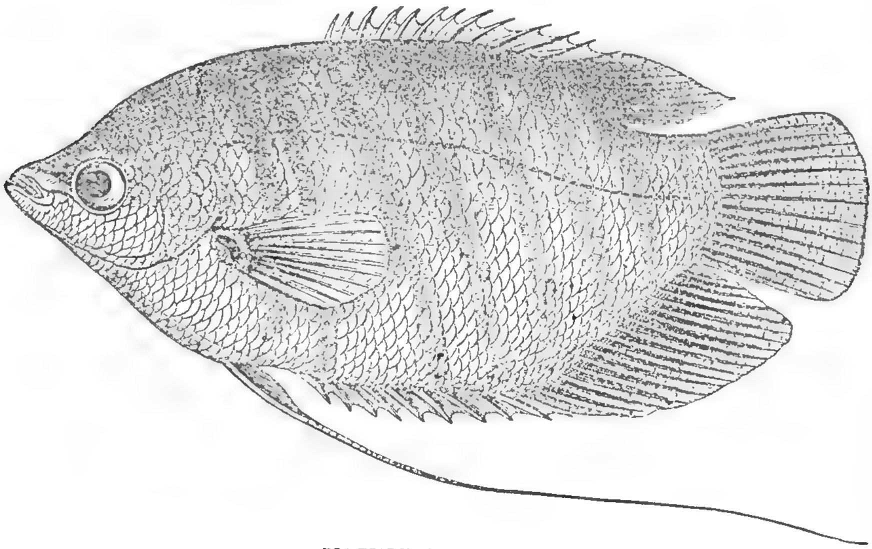
Fish culture and fish acclimatisation, though intimately connected, are by no means identical. Comparatively little has yet been accomplished in fish acclimatisation. Most nations are satisfied with the varieties they already possess, and confine their attention to the cultivation of their best. This is notably the case with the Chinese, and largely with the Americans. We Australasians do not attempt fish culture, excepting in connection with acclimatisation. This is a remarkable fact, seeing that we possess, in some of our fresh waters, fishes of considerable value.

Fish culture has been successfully practised for centuries, more especially by the Chinese, who brought the art to a high state of excellence; they are now, however, surpassed by many who have only recently devoted attention to the subject. The Americans have exceeded all others in vigour and in the magnitude of their operations. In one year the United States Fisheries Department dealt with upwards of a billion of fry and ova, and the various States fisheries as many more. Canada and the European nations, also most of our own colonies, notably New Zealand, have accomplished good work. Queensland is the last to turn her attention to the subject. The business of Trout acclimatisation has been commenced by a few enterprising and patriotic gentlemen at Warwick, and with very satisfactory results, as may be learnt from the first annual report of the Acclimatisation Society of Southern Queensland. It is stated in the report that in the winter of 1896 our Government purchased from the Wellington Acclimatisation Society 32,000 ova, which the New South Wales Fisheries Commission kindly undertook to supervise at their ponds at Prospect. In November the fry, of which there were less than 4,000, were sent on to Warwick. Since they were placed in their boxes at Killarney, the mortality has been very slight indeed. The manager reports that the fish have made phenomenal growth, some of them having already attained a length of ten inches, a fact which proves that the waters in which they are located are eminently suited for trout culture. About 600 of the finest fish have been retained for stock purposes. The remainder have been placed in streams from beyond Stanthorpe to Toowoomba. It is anticipated that an ample supply of ova will be obtained from the fish in stock next year. A case, containing 10,000 Brown Trout ova and 7,000 Rainbow Trout ova, was this season received from the Wellington Society. It is gratifying to know that all the necessary conditions to ensure success exist at Warwick and Killarney. It may reasonably be presumed that, in the near future, trout-fishing will be one of the sports of Queensland, as it has been for some time of New Zealand, Tasmania, and Victoria. It is to be hoped that the industry will not long be confined to the Downs nor to trout. There are many suitable waters in Queensland besides those already stocked, and there are other excellent fishes deserving of attention. Warwick, fortunately, possesses capable and energetic men who command sufficient funds to carry out the work. Do not these conditions exist elsewhere in Queensland? If they do, why cannot the Warwick example be followed?

I append to this a short account of an excellent fish which should be imported into Queensland.

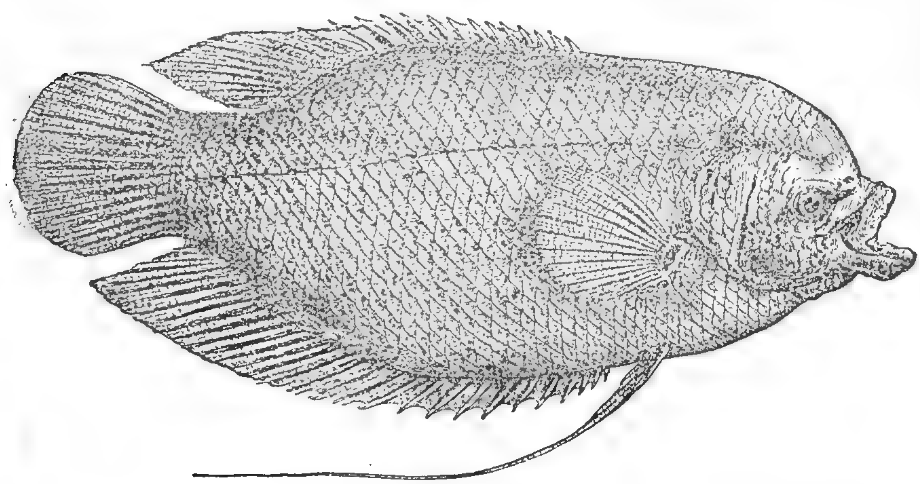
THE GOURAMI.

There is probably no fish that could be so easily acclimatised in Queensland waters as the "Gourami," of the Mauritius, and it would be difficult to name one that can compare with it in economic value. It is certainly inferior to trout from a sportsman's point of view, but otherwise it is far and away the more important fish. Why it has not long ago been acclimatised in Queensland, it is difficult to say; most likely because we do not yet recognise its great value. Or is it that we lack the enterprising spirits that abound on the Downs? Anyone who is conversant with the transport of live fish might in a few weeks establish the Gourami in Queensland. A couple of hundred would be ample. The work should not be delayed any longer; it can be easily and



YOUNG GOURAMI.

speedily accomplished, nor need the cost be great. This remarkably fine fish is said to have spread to other places from Cochin China, its original habitat, where it exists in a wild state and attains considerable size, up to 100 lb. weight.



FULL-GROWN GOURAMI.

In other countries the Gourami is kept in captivity, and is thoroughly domesticated. It is usually marketed before it attains a weight of 12 lb.; probably it is then better eating and more profitable than when larger. Persons who have

eaten the Gourami consider it the finest of all fish. The flesh is of a pale-straw colour, firm, flaky, and very delicious. The fish is, like our *Ceratodus*, very tenacious of life. It is taken to market alive, and, if not sold, is reprieved for a time and returned to its pond. The Gourami is very hardy, and grows fast; it is, although mainly a vegetable feeder, omnivorous in its taste—waste food of any description is acceptable to it. Anyone having a pond in his garden or yard can keep Gourami, and when one is wanted for dinner a scoop-net is all that is necessary for capture. The colony of Victoria made persistent efforts to introduce the Gourami from Mauritius between the years 1859 and 1864, but they all resulted in failure, principally owing to the fact that at that time the fish were transported by sailing vessels, when they received little attention, and the work was reluctantly abandoned. Two feeble attempts were made by our colony, but failed through mismanagement. Any person having a lagoon could cultivate Gourami; indeed, it would be difficult to find a new industry that would yield such satisfactory results. If the Queensland Agricultural College possesses a lagoon or suitable pond, fish culture would be a valuable and interesting addition to the already excellent curriculum.* The accompanying illustrations have been supplied to me by the proprietors of the *Queenslander*.

* There is a very good deep sheet of water at the College, which should be eminently suited for the purpose.—Ed. *Q.A.J.*

General Notes.

A WARNING WORD TO BEEKEEPERS.

During the honey harvest many colonies will become queenless unless we are very careful. This most frequently occurs with those that contain virgin queens, and these are the ones that need them more than others. Such colonies are usually destitute of brood, and will become a total loss in all probability unless prompt remedial measures are taken. It is easily ascertained by examination if all colonies have laying queens, as eggs and brood will appear in the combs if such is the case. These indications are very prominent in the hive, and may be seen on the most cursory examination. To put a queenless colony in good working order insert a frame of brood in their hive, and if this is not over three days old, the colony will invariably raise a queen from it.

THE BEST WAY TO KILL POULTRY.

Major Traill, a well-known authority on all that pertains to the poultry yard, considers that the best method of killing fowls is by dislocation of the neck. In this opinion I entirely agree with him, for it is not only the most humane plan, but also the most satisfactory when regarded from the point of view of general appearances. When the vertebral column is broken there is no more sensation, and the method is much more cleanly than that commonly adopted, as there is no bleeding. The process is as follows:—Take the bird by wings and feet in the right hand, and its head between two of the fingers (first and second) of the left hand, close behind the skull, the back of the bird being upwards. Hold the legs tight against the right hip, bend the bird's head backward (the palm of the left hand being turned to the left), and at the same time firmly extend the bird till the neck is dislocated just below the junction with the head, and death will immediately ensue. Care must be taken not to use more than the actual necessary extension, or the head will come off or the skin of the neck be torn. Muscular contraction will be noticeable for a few minutes, but if the operation is effective no pain is suffered.—*Exchange.*

FAMOUS POTATO-SPRAYER.

Messrs. Strawsons, 75a Queen Victoria street, London, have rendered a great service to potato-growers by the invention of their now well-known Strawsonite or sprayer for checking potato disease, and improving the quality of potatoes. The experiments made by Lord Clonbrock and others conclusively prove that growing potatoes sprayed with the preparation of sulphate of copper used with the Strawsonite machine increases in quantity from three to four tons an acre, that the potatoes are of much superior quality and keep good longer. Potato blight is simply microbes or insects. For 28s. 9d., Messrs. Strawsons will supply a machine which may be carried on the back in knapsack form, and which (as the *Times* says) will guard "crops with almost absolute certainty against destruction."

A CHEAP FOOD FOR THE CHICKS.

Fowls of all varieties are extremely fond of onions, and derive great benefit from eating them. They not only serve all the purposes of food, but aid digestion and tend to ward off disease. They may be given in a raw or cooked state. Chickens will eat not only the bulbs, but the leaves when they are chopped up and mixed with the soft food. Chickens that are allowed onions prepared in this way rarely, if ever, have cholera, and are not likely to be infested with vermin.

CREAM RIPENING.

The dairy instructor at the Cornell University, America, is responsible for the following suggestions on the ripening of cream, and he speaks from the standpoint of official authority and responsibility:—"Keep your milk vessel so that its contents may ripen evenly, and thus avoid loss in churning. Raise the temperature to 62 or 68 degrees, and keep the cream as near as possible to that temperature until it is ripe, and then cool before churning. Well-ripened cream should be coagulated or thickened. It should run from a height in a smooth stream like oil. When a paddle is dipped into it and held in the hand, it should stick all over it in a thick, even coat, not running off in streaks and showing the surface of the paddle. Churn until the granules are the size of wheat kernels, then draw off the butter-milk, and wash through two or three waters, whirling the churn a few times around. Use from a pint to a quart of water per lb. of butter. Have the water at a temperature of about 40 degrees to 45 degrees in hot weather and from 50 degrees to 62 degrees in winter, always depending upon season, natural solidity of the butter, warmth of room, and size of granules."

SHOWING A HERD.

In showing a herd privately to visitors, a certain amount of judgment is required to make the best impression. This is sometimes a matter of pounds, shillings, and pence, but it is more than that. If an artist paints a good picture he does not hang it upside down, nor in a bad light, nor place it beside a picture of conflicting colour. It is no mere trick of trade, but an act of good taste, which no honest man would be ashamed to own, to place cattle so that they can be seen to advantage; not beyond their merits, for that is out of the question (putting aside such mean devices as the herdsman's hand "accidentally" laid upon the nose which happens to be a black one, in a buff-nosed breed), but it is simply causing the merits which are there to be fairly seen. The animal led out in a halter, or the bull led by staff or cord to the nose, should be walked about in a way to be shown properly all round, and when pulled up should not have the fore-quarters stuck down in a hole, nor be allowed to stand with one foot in an unusual position, throwing the whole frame out of form. The attendant should remember that the visitor wants to see, not him, but the animal he leads, and therefore should not interpose his own person in the line of view; and if he have a bull by the nose, by all means he ought to remember that a bull's head is not an ant-eater's. One does see a noble head sometimes utterly ruined by the elongation of the nose with a very unnecessary dead pull, to which it yields like India-rubber. The same pull, too, brings down the majesty of the crest, making the grand arch of the neck disappear. There is much, also, in a fit assortment of cattle. The late Mr. Hugh Aylmer, of West Dereham Abbey, Norfolk, used to have his Shorthorns grouped separately in different fields, according to age: the aged cows, the three-year-old cows, the two-year-old heifers and the yearlings, and the weaned calves had their own houses and exercise-ground. About the yards also, a similar arrangement was observed in the occupancy of the houses and boxes.—*Agricultural Gazette.*

TO MAKE A CREAM CHEESE.

Take about a pint of cream that has thickened in the cream-pot, and pour it into a coarse linen cloth lining a basin. Gather the cloth in your hands and tie it tightly with string just above the cream, leaving a loop whereby to suspend it from a hook in the dairy. Place a basin beneath for the drippings. Leave it overnight. Change it into another cloth next day, and after another night it will be thoroughly drained. Have ready a wooden box about 7 inches by 5, or one of the same size but divided into four, as it is sometimes more convenient to have four small rather than one large cheese. Wring out some muslin in cold spring water, and line the box with it. Some persons use corduroy, by placing it under the muslin, to groove it. Straws do equally well.

I have also used the ribbed brown paper used by doctors and wine merchants for sending medicine or wine sample bottles by post. Press the cream into the mould, draw the muslin over the top, and cover with a dish, on which is an iron or heavy weight. Put it on another dish, and leave it about twenty-four hours. It should then be quite firm. Turn it out by taking the muslin from the press and letting the cheese slip on to the lettuce. If preferred mouldy, keep it in a damp place for a few days.—*Agricultural Gazette.*

FARMERS' PIGS.

There are few animals, except perhaps the hen, that Queensland farmers as a rule neglect so much as the pig—that is, as to its food and housing. It is one of the commonest sights to see really well-bred pigs kept in a log stye with often no roof, or, if there be a roof, it is so badly arranged that the rain blows right through the stye. Then, again, when the owner takes the trouble to floor the stye, he does it with crooked logs or waste bits of slabs, posts, and rails. These sink rapidly into the mass of sludge resulting from the trampling of sweet-potato vines, pumpkins, green corn, &c., which have been thrown into the animals at odd times. If there is a trough, how often is it cleaned out, not to speak of the luxury of scalding out? The feeding takes place at any time, and, except on well-regulated farms, the food takes the form of the easiest stuff to gather together, and that is pitched in amongst the muck in which the neglected brutes have to wallow day and night, winter and summer.

Now, anyone who has a smattering of knowledge of swine knows that the pig is naturally a clean animal, and responds gratefully to washing, hosing, and scrubbing. He only wallows in mud because he is hot and the mud is cool. He likes a warm, dry bed; and the careful breeder will see that he gets it, for much of the profit of the pig depends on his housing as well as on his food. He should not be kept too warm, but neither should he be left to shiver in icy wet blasts for days and nights together in winter. In such a case he requires far more food than if he had a comfortable bed of straw, protected from the rain. Which pays best? To spend a little time and trouble on his house, or to supply him with as much corn and boiled food as would fatten two pigs well cared for.

Pigs should, if possible, be allowed a run, especially the sows before farrowing time. But how seldom does the latter get a chance to run about and root and strengthen herself to support the litter? With a little trouble the lives of pigs could be made more comfortable, and the owner's profits would increase.

BUTTER FACTORY PRICES.

A correspondent, who is one of the most prominent dairymen in the district, sends us (*Bundaberg Mail*) a few particulars which should satisfy the most sceptical as to whether it will pay to send cream to the butter factory or not. During the past week he separated 224 gallons of milk, which produced 118 lb. of butter; or 1·81 gallons of milk for each pound of butter, thus showing that his dairy herd must be of a very superior kind. His butter realised £7 17s. 4d., or 16d. per lb. Our correspondent inquired of Mr. McCormick what price the butter factory would pay per lb. for cream from milk of that quality, and he was told 8d. per lb. On weighing his cream he found that, if the butter factory had been in operation, he would have received 2s. 6d. more for the raw article than he got for his butter, without counting the cost of manufacture and trouble of finding a market.

PORT WINE FROM MALTING BARLEY.

Mr. E. Neville-Rolfe, Her Majesty's Consul at Naples, in his annual report for the year 1896 on the trade of that town, says:—"The method of exporting grapes was formerly a very wasteful one, and a new plan has now been devised. Large tanks have been constructed to run on the railway lines. These wait at the sidings during the season, and the exporter simply brings his grapes to the

station, turns them into the tank, and sends them off by the first available train to Switzerland or Germany. On arrival at their destination, these crushed grapes go straight to the factory, and may be reckoned to produce 70 per cent. of wine at their first pressing, apart from the by-products. Of these tartaric acid is the principal, but the grape-stones are said to make excellent chicken food, while the stalks and skins when burnt to ashes form very good ley for washing purposes. The total export of crushed grapes amounted last year to about 8,000,000 tons."

Allusion is also made to the recent discovery in Germany of the possibility of making artificial wine (especially port) from malting barley by the introduction of the bacilli of port wine into the mead. These bacilli transform the immature beer into port, and, when they have done their work, can be sterilised, a sufficient stock of microbes being preserved in the laboratory for further use.

[*Foreign Office Report, Annual Series, No.* 1868.]

JERSEY BULLS FOR SOUTH AUSTRALIA.

At Trenchard's sale of pure-bred stock last week, the South Australian Agricultural Department purchased a collection of valuable high-class Jersey bulls for the use of the various dairying centres in that colony.

CENTRAL WINE CELLARS.

When receiving a deputation of vignerons the other day, the Victorian Minister for Agriculture stated that he contemplated discussing with his colleagues the question of the desirability of establishing central wine cellars for the blending and making of wines.

RAILWAY REVENUE.

From the report of the Queensland Commissioner for Railways for the year ended 30th June, 1897, we learn that the revenue from agricultural produce has advanced from £63,068 in the previous year to £83,333 during the present year. That the railway revenue from this source should have topped previous records by £20,265 is good evidence that the efforts of the Government to stimulate and assist the agriculturists have not been without marked effect. Not only is the individual farmer benefited, but the colony as a whole derives an advantage by the broadening of the foundations of railway revenue and its constantly improving source attendant upon the moving of crops. We may, if the season continues as favourable as at present, look confidently forward to a further expansion in this direction. Amongst the crops which have contributed to this very satisfactory state of affairs, sugar and sugar-cane take a prominent place, but all other farm produce shows a substantial increase. The Southern line and Killarney branch forwarded during the year under consideration 45,000 tons of produce, as against 30,000 tons during 1895-96. The tonnage from Wallangarra, coming over the border from New South Wales, was 1,365 tons (principally potatoes), as against 521 tons for last year.

The totals are 256,981 tons, against 193,612 tons; and the revenue from this was £83,333, as against £63,068. In the Roma-street cold stores, as much as £17,000 worth of butter has been stored at one time. It is observed in the report that imports of maize, bran, and pollard have nearly ceased, and that flour from the southern colonies has also decreased. A further reduction will probably be suffered, as our own wheat crop promises an abundant yield, and additional flour-mills are being erected at Toowoomba and on the Downs.

ADULTERATED TOBACCO.

The *Louisiana Planter* is responsible for the statement that, "amongst the worst frauds on the Ohio market, are a number of brands of tobacco." This should stimulate our Killarney and Texas friends to create a taste for their pure tobaccos, which will doubtless be eventually rendered equal to the best brands of the American weed, when the newly appointed tobacco expert has settled down to his work.

CAPE GOOSEBERRIES.

It has been often stated that Cape gooseberries are only prolific when they spring up spontaneously after a maize crop, and that no profit would be derived from sowing the seed. Mr. Butts, of Palmwood, Blackall Range, shows practically how erroneous this idea is. He sowed two acres of seed in November last on unbroken scrub land—that is to say, the timber had been felled and burnt off, but the soil had not been broken up. He placed the gooseberries in a tub of water, and washed the seed out of the pulp. These seeds were dried, then mixed with a quantity of dry ashes to equalise spreading, and then sown broadcast over two acres. The result has been that these two acres are covered with a luxurious growth of bushes, and the weight of crop may be inferred from the fact that one woman and two boys, paid at the rate of 1½d. per quart, cleared 21s. in three days. The fruit is sent to the Brisbane jam factories, where it realises 6d. per quart. Mr. Butts intends sowing from four to five acres during the coming month. The wages made at picking gooseberries should hearten the coffee-planters against the lugubrious prognostications of there being no pickers for the crop.

AGRICULTURAL AND HORTICULTURAL SHOWS.

The Editor will be glad if the secretaries of Agricultural and other Societies will, as early as possible after the fixture of their respective shows, notify him of the date, and also of any change in date which may have been decided on.

SHOW FIXTURES.

Gympie Agricultural, Pastoral, and Mining Association	6th and 7th October.
Ipswich and West Moreton Agricultural and Horticultural Society	7th and 8th October.
Horticultural Society of Queensland—Spring Rose Show	(about) 12th October.
Ipswich and West Moreton Agricultural and Horticultural Society	14th and 15th October.

The Wheat Crops.

NEW SOUTH WALES.

The *Daily Telegraph* estimates the acreage under wheat in that colony at 1,174,000 acres, allowing a percentage for hay. The yield on the average production for the last ten years should be 11,622,600 bushels against 8,853,415 bushels last year. This is enough to meet the colony's requirements, and leave an exportable surplus of 2,500,000 bushels. The prospects of an abundant harvest are also very bright in Queensland, Victoria, and South Australia. The visible American supply is now estimated at 20,073,000 bushels.

The *Corn and Produce Gazette* of 4th August reports that the United States wheat crop is now estimated at 72½ million quarters, being only 2½ millions less than the heaviest crop produced—viz., 1891. With 8 million quarters of old wheat, the total available at 1st ultimo was thus 80½ million quarters, out of which 30 millions might be exported. The wheat crop in Manitoba is estimated by Canadian statisticians at 25 million bushels.

Reports from foreign countries do not improve as the harvest advances. In France the crops had suffered considerably from drought, and the latest accounts of the harvest in Italy and Hungary are more unfavourable than early reports, while the damage done by rain and floods in Roumania, Bulgaria, and in various parts of the continent of Europe appears to have exceeded the worst expectations. With respect to Russia too, the impression that the wheat and rye crops will show considerable deficiencies as compared with last year's production gains in assurance every week. Even in the United States there have been rumours of damage to the spring wheat crop, and, although these have been promptly contradicted, it is possible that there is some degree of truth in them.

The Markets.

AVERAGE MARKET PRICES FOR JULY AND AUGUST, 1897.

Article.	—	JULY. Top Prices.	JULY. Bottom Prices.	AUGUST. Top Prices.	AUGUST. Bottom Prices.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bacon	lb.	0 0 6	0 0 3	0 0 6	0 0 4
Bran	ton	4 15 0	4 10 0	3 8 1½	3 1 3
Butter, First	lb.	0 1 4⅛	0 1 1	0 1 5 1/16	0 1 2¼
Butter, Second	,,	0 0 10 7/16	0 0 8	0 0 11⅛	0 0 8
Chaff, Mixed	ton	4 15 0	2 15 0	4 10 0	2 11 3
Chaff, Oaten	,,	5 10 0	3 0 0	5 6 3	3 0 0
Chaff, Lucerne	,,	5 3 9	3 2 6	4 17 6	2 13 9
Chaff, Wheaten	,,	3 10 0	2 12 6	4 0 0	2 10 0
Cheese	lb.	0 0 6½	0 0 2⅞	0 0 6½	0 0 3½
Flour	ton	15 12 6	13 2 6	15 0 0	13 5 0
Hay, Oaten	,,	4 15 0	3 7 6	4 12 6	2 15 0
Hay, Lucerne	,,	4 0 0	1 17 6	4 0 0	2 0 0
Honey	lb.	0 0 2 3/16	0 0 2	0 0 2⅙	0 0 2
Japan Rice—Bond	ton	13 10 0	13 0 0	13 10 0	13 0 0
Maize	bus.	0 2 5½	0 2 3¾	0 2 2¼	0 2 0½
Oats	,,	0 4 0	0 3 0	0 4 0	0 3 0
Pollard...	ton	5 6 3	4 17 6	3 13 1½	3 5 0
Potatoes	,,	6 0 0	3 12 6	6 17 6	4 7 6
Potatoes, Sweet	,,	2 0 0	1 15 0	2 0 0	1 15 0
Pumpkins	,,	2 11 3	1 8 9	2 18 9	1 6 3
Sugar, White...	,,	16 7 6	14 0 0	15 10 0	14 0 0
Sugar, Yellow	,,	13 10 0	12 0 0	13 7 6	12 2 6
Sugar, Ration	,,	11 15 0	11 0 0	11 7 6	11 0 0
Wheat	bus.	0 4 8¼	0 3 3	0 5 3¾	0 3 6
Onions	cwt.	0 10 10⅓	0 9 0	0 11 7½	0 10 6
Hams	lb.	0 0 7¾	0 0 6¾	0 0 8	0 0 7
Eggs	doz.	0 0 8⅝	0 0 8⅛	0 0 5⅞	0 0 5⅜
Fowls	pair	0 3 3¾	0 1 9	0 3 7½	0 1 9
Geese	,,	0 6 2¼	0 5 3	0 6 5¼	0 5 0¾
Ducks, English	,,	0 3 5¼	0 2 8¼	0 3 5¼	0 2 11¾
Ducks, Muscovy	,,	0 4 3¾	0 3 3	0 4 2¼	0 3 3¾
Turkeys (hens)	,,	0 6 0¾	0 4 4½	0 6 1½	0 4 9
Turkeys (gobblers)	,,	0 11 10½	0 7 7½	0 13 0	0 8 0

WHEAT SUPPLY OF THE UNITED STATES AND FRANCE.

THE "visible supply" of wheat in the United States, exclusive of California and Oregon, was returned at 15,324,000 bushels for the week ended 17th July, 1897, showing a decrease of 1,285,000 bushels on the week. The quantity "in sight" for the corresponding week in 1896 was 46,743,000 bushels, and 40,483,000 bushels same time in 1895. The "visible supply" of maize stands at 15,130,000 bushels, showing a decrease of 295,000 bushels on the week. The quantity "in sight" for the corresponding week in 1896 was 8,666,000 bushels, and 5,941,000 bushels same time in 1895.

It is reported that the French wheat crop will be short by 90,000,000 bushels.

THE BRITISH MEAT TRADE.

Dead Meat.

The trade has been inactive, owing to the hot and thundery weather. At the Central Meat Market, business was very dull, except for lamb, which was scarce. The trade has continued dull, but lamb has sold steadily, very little of it being on offer.

The *Agricultural Gazette* (London), writing of the meat trade on 26th July, says:—"Very slow trade. Heavy supplies. Difficult to effect sales."

	s. d.		s. d.		s. d.		s. d.
Beef—top quality	0			Mutton—top quality	5 2		
Second	3 0	to	3 4	Second	4 4	to	4 10
Inferior...	2 6	,,	2 10	Inferior...	2 8	,,	3 0
Veal—top quality	4 4			Pork—small	3 8		
Middling	2 8	,,	3 4	Large	2 8	,,	3 0

H. Duckworth and Sons, 38 and 39 Central Market.

	s. d.		s. d.
Beef (American) hindquarters	3 2	to	3 6
,, ,, forequarters	1 6	,,	1 10
Mutton (Canterbury, New Zealand)	2 4		
,, (River Plate)	1 8		
,, (Australian)	2 0		

THE LONDON BUTTER MARKET.

Danish, firm—finest, 94s. to 98s.; fine, 86s. to 90s. Finnish, steady—finest, 82s. to 86s.; fine, 76s. to 80s. Russian, 76s. to 80s. Friesland, quiet—factories, 84s. to 88s.; dairies, 80s. to 82s. Italian, slow—rolls, 9s. to 9s. 6d. American and Canadian, quiet—finest, 80s. to 86s.; good to fine, 56s. to 78s.; 68,000 tons of butter were received in the London market during the second week of August.

Farm and Garden Notes for October.

As the warm weather is now at hand, and showers may be expected, weeds will be on the increase; therefore the horse-hoe and cultivator should be constantly at work in keeping the crops clean. Do not let the weeds get ahead of you and seed, as one year's seeding means seven years' weeding, but keep them down vigorously. Earth up growing crops, and keep the ground loose amongst them. Plant sweet potatoes, yams, earth-nuts, arrowroot, turmeric, ginger. Sow and plant out tobacco. Sow maize, sorghum, setaria, imphee, Kaffir corn, Johnson grass.

In the Kitchen Garden keep all crops clean, mulch and water when necessary. Cabbages may be transplanted, being careful to check the aphis on its first appearance. Sow parsley, peas, French and kidney beans, mustard cress, radish, lettuce, cucumbers, melons, egg-plant, pumpkins, tomatoes, rhubarb, spinach, vegetable marrows, custard marrows, carrots, parsnips, &c., &c. Asparagus beds will require plentiful watering and a good top-dressing with short manure. Rosella seeds may be sown during this month. No farm should be without rosellas. They are easily grown; they bear heavily, and make an excellent sub-acid preserve, whilst they are infinitely preferable to the mulberry for puddings and pies. An excellent wine is produced from the rosella, and, in addition to this, the bark yields a stout fibre, which comes in handy for many purposes, such as tying up plants and trees to stakes and trellises.

The Flower Garden is now showing the result of the care bestowed upon it during the past two months The principal work to be done during this month is the raking and stirring of the beds, staking, shading, and watering. Annuals may be sown as directed for last month. Plant gladiolus and other bulbs, such as tuberose, crinum, ismene, amaryllis, pancratium, hermocallis, hippeastrum, dahlias, &c., &c.

Orchard Notes for October.

By ALBERT H. BENSON.

Keep the land well cultivated, using the implements described in the article on "Fruit Culture" in this month's *Journal*, and, if dry, see that the land is well stirred, but not turned. If weeds are troublesome, use the broad, surface-working knives, which cut the whole of the ground; but if there are few weeds, then use the narrow-cultivator teeth. Attend to the disbudding of all young trees, for if superfluous growths are checked now, they are converted into fruit-wood, and the vigour of the tree is thrown into those shoots which are to form the future branches of the tree. Disbud all vines, rubbing out all superfluous shoots, leaving only as many canes as the vine is strong enough to mature fruit to perfection on.

Sulphur all vines to prevent oidium, as, if there is any muggy weather during the month, this disease is sure to make its appearance. Where Black-spot is present, spray the vines with Bordeaux mixture, and if caterpillars are troublesome as well, then add 1 oz. of Paris green to each 2 gallons of Bordeaux mixture, and both pests will be destroyed by the one spraying. When using Bordeaux mixture, there is no necessity to use sulphur for oidium, as the Bordeaux mixture answers equally as well. Don't spray when the vines are in blossom; but with varieties that are shy setters, it is often a good plan to sulphur when in blossom.*

The nursery should be carefully attended to; where not already done, the ties of all grafts should be cut and the scions should be trained so as to make a single upright stem. Where buds have been put in, they should be started by cutting back the stock sufficiently to cause them to grow, but the stock should not be cut hard back all at once, but by degrees, always leaving a portion of the stock above the bud to tie the young shoot to. Plant pines and bananas during the month, selecting suckers from healthy plants and from plants that are good croppers, and that produce good fruit, as a careful selection of suckers always pays well. Continue the treatment for Maori or Rust Mite of the orange recommended in the Notes for September; and where orange bugs, either the green or bronze, are present, destroy every mature insect that can be found, so as to prevent them breeding, as the killing off of the first crop will materially lessen their number for the season. Hand-picking, though slow, is probably the best remedy, though, before the insects are fully grown, large numbers may be destroyed by driving them on to the main branches of the tree and sweeping them off with a broom on to a cloth, from which they can be gathered and killed. Take every possible precaution against the fruit fly by destroying every infested fruit that you can. If there are maggots in cumquats or any other fruits, destroy every one, as the cleaner the sweep that is made of the first crop of flies, the less trouble there will be throughout the season. Where Scale Insects have been introduced on young trees into clean districts, every care should be taken to keep the pest from spreading; and in cases where the young trees are badly affected, it will pay the grower to destroy them at once, as the first loss will be the least. Where leaf-eating insects of any kind are troublesome—such as caterpillars of kinds, the larvæ of the fig beetles, or the false ladybirds that attack all kinds of cucurbitous plants, potatoes, &c.—they can be readily destroyed by a spraying of Paris green, 1 oz. to 10 gallons of water, with lime added in as large a quantity as can be got through the nozzle of the pump without choking, as this will tend to make the poison stick on better to the leaves, branches, or fruit.

* The State of Vermont (U.S.A.) has, at the request of the Vermont Beekeepers' Association, passed a new law imposing a fine of from 10 dollars to 40 dollars for spraying or otherwise applying Paris green or other poisonous substances to fruit trees when in blossom.—Ed. *Q.A.J.*

New Publications.

We are in receipt of Vol. I., No. 1, of the *Journal of Agriculture and Industry* of South Australia, issued under the direction of the Hon. Minister of Agriculture and Industry. It is, as its editor (the general secretary, Agricultural Bureau of South Australia) says, an old friend in a new dress, and in its present form compares favourably with similar publications of the other colonies. The present number contains interesting and valuable articles on most subjects connected with agriculture, fruit culture, packing fruit, &c., which will doubtless be most acceptable to those interested in the progress of the various industries comprised under the head of "Agriculture."

Registered at the General Post Office as a Newspaper.]

THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. A. J. THYNNE, M.L.C.,

SECRETARY FOR AGRICULTURE.

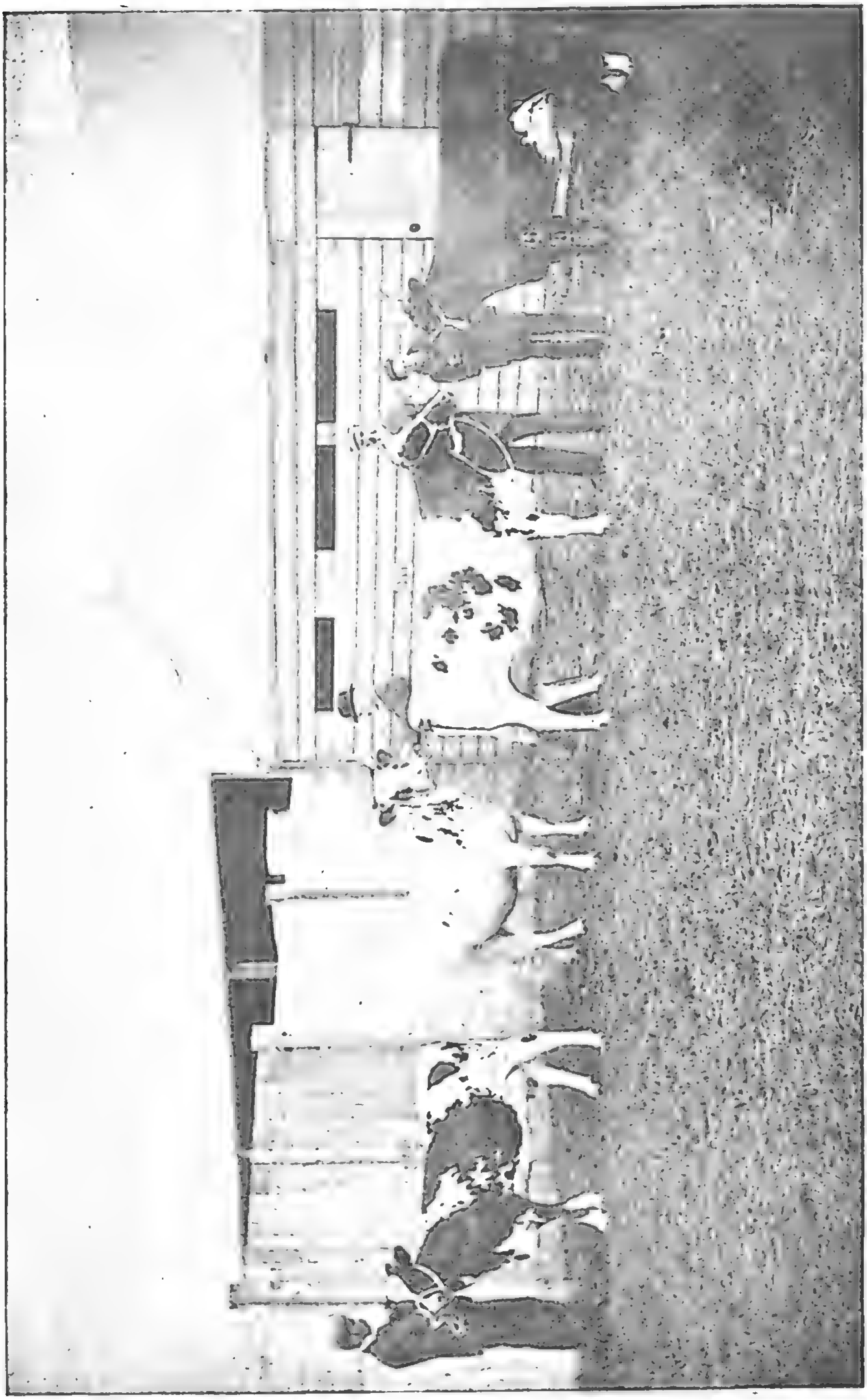
VOL. I. PART 5.

NOVEMBER, 1897.

By Authority:

BRISBANE: EDMUND GREGORY, GOVERNMENT PRINTER.

1897.



SONCY OF OUTMAINS. LADY FLORA. BRIGHT LADY. BEAUTY.

DAUGHTER OF BRIGHT SMILE.

Ayshire Prize Winners—Dumfries Highland Show, 1895.

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CONTENTS.

Wheat Prospects at Westbrook.

Reporting to the Under Secretary for Agriculture on the 19th October, Mr. Henry Tardent, manager of Westbrook Experiment Farm, says:—

This season, as you are aware, is extremely favourable to the development of rust. I have this last month kept a constant watch to see its progress amongst the 341 varieties which form the collection planted this year on the Experiment Farm. Up to the 5th October no traces of rust could be detected. On the 7th the following varieties were slightly affected:—Gharof, Sherman, Shelton's Russian, Beal, Quartz (on the stem), Early Bearded (ditto), African, Archer's Prolific, Cythera White, Gore's Indian No. 1, Velvet Chaff, Red Grain, Langfeldt's, Indian Early, King's Jubilee, Pride of Barossa, Steinwedel, Fillbag, Red Tuscan, Purple Straw Tuscan, Chrysolite, Bladette Paylanreuse, Russian, Smooth Red Spring, Trap, Hallet's Pedigree, Goldsmith's Pedigree, Carter's New Hybrid, Golden Drop (these two latter on the stem), Dwarf Humbold, Blé ā épi carré, Mould's Red, Clubbed Indian, Indian D, (these two on the stem), Budd's Early, Ward's Prolific, Hercules, Red Clawson, Ward's White, Marshall's No. 5 (on the stem), Roussillon, Robin's RR Genessee. This forms about 10 per cent. of the whole collection.

The subsequent heavy showers seem to have rather checked the progress of the rust than otherwise in the above varieties, for on the 20th October it had rather lost ground on the varieties attacked, on none of which is it so far bad enough to seriously compromise the crop of grain. However, it has during those two weeks extended on the following varieties:—

Egyptian C 1, Blue Heron, Bailey, Robert's, Rural New Yorker, Australian Bearded F 1, Early Japanese Ruby, Lazistan, Penguin Island, Pringle's 5, Thuis Miami Valley, Crate, Barbu Gros Grain, Early Baart, Dutoits, Johnson's, Champlain's Hybrid, Uncle Tommy, Soft Algerian, Canning Downs, Gore's Indian 2, Indian Club, Andros, Pride of Butte, Old French Velvet, White Velvet, Canadian Velvet Chaff, Jones' Winter Fife, Velvet New Zealand, Velvet Pearl (on the stem), Indian Fife, Indian F, Indian Z (on the stem), Carter's 81, Early Para, The Blount, Northern Champion, Italian-Tuscan, Purple Straw, Jacinth, Australian Glory, Stear's Early Purple Straw (on the stem), White Tuscan, Frame's Early (on the stem, also it has some smut), Red Tuscan, Purple Straw Tuscan (on the stem), Californian Chili, Oakshott's Champion District, Agathe (both latter on the stem), Carter's B, Hunter's White Naples, Australian Talavera, Snowball, Talavera de Bellevue, Pringle's Vermont, Prope, Frampton, Chiddam's, White Spring, Martin's Amber, Soft Australian, Gneiss, Fort Collins, Hedgerow, Little Club, Zimmermann, Sardius, High Grade, Long Berry, German Beardless-March, Blount's Fife, Small's OK, Anderson's RR, Sorrel, Improved Rice Ontario Wonder, Nimitybelle, Indian Y, Ruby, Feldspar, Pringle's Defiance, Pearl or Velvet, Little Wonder, Carter's H, Pringle's 6, Opal Majorica Carusa, Carter's A, Golden Prolific, Marshall's 3, Marshall's 2, Clawson, Red Russian.

The following varieties are, up to date of writing (20th October), entirely free from rust. They include some varieties which are nearly ripe, and others which are still as flat as a tuft of couch-grass:—

Egyptian E, Sicilian Baart, Forella, Mica, Medeah, Egyptian C 2, Egyptian D, Egyptian A 1, Egyptian A 2, Young's Bearded, Paros, Atlanta, Banatam, Cretan, Belatourka, Missogen, Bearded Club, Pugh's RR, Salvator, Hebron, Hunter's White, Algerian, White-eared Mummy, Brown-eared Mummy,

Egyptian B, Egyptian F, Australian Poulard, Bancroft's, Egyptian H, Laidley, (in fact, all the Durum family except one), Poland, Diche Mediterranean, Ladoga, Hindustan, Tasmanian Red Lehigh, Brogan's Red White, Anglo-Australian, Trondad Rieti, Ulturo Red, Champlain, Bearded Herisson, Winter Nigger, Bearded Champion, Reliable, Frument Terrasseuse, Bearded Monarch, Deitz, Tulcaster, New Red Wonder, Jasper, Saratow, Rio Grande, Mediterranean, Australian Amber, Soft Portuguese, Darblay's Hungarian, Andriola Amber, China Tea, Democrat, Californian Genessee, Full-bearded Neapolitan, Bearded Velvet, Gone Rivet, Carter's 87, Carter's F, Tardent's Blue, Carter's D, Brigg's RR, Basalt, Carter's 43, Rye Wheat, Fountain, Battlefield, Blue Straw, Carter's E, Bordier, White Tuscan-Lake Bathurst, White Flanders, Chiddam, White Lammas, Green Mountain, Damas, Leak's RR, White Lammas (from Young), Zealand, Mammoth, Carter's 103, Port McDonald, White Essex, Tuscan Essex, Shilf, Summer Club, Manitoba, Prince Edward Island, Mouton, China Spring, Buckley's RR, Utolea, Pictet, Red Nott, Blount's RR, Fultz, Noe, Crepi, Saumur de Mars, North Carolina, Autumn Saumur, King's RR, Niagara, White-Chaff Red, Scotch Red, Saskatchewan, Scotch Fife, Finley, Inglis' RR, Count Waldersdorf, Canadian Club, Carter's B, Amethyst, Gallician, Saumur, Dominion, Red Lorraine, Sardonyx, Kaiser, Sapphire, Indian D, Webb's Challenge, Eclipse, Horneblende, Jock, Porcelain, Wright's RR, White Russian, White Fife, Adamant, Fluorspar, Improved Fife, Clark's RR, Beryl, Australian RR, Thomas's RR, Leak's Defiance, Russian, Murray River, Defiance, Bega A, Inglis' Success, Blount's Lambrigg, Trump, Carter's K, Carter's 107, Bersler's Club, Scholey's Squarehead, Behthorn's Dividend, Emerald, Red Altkirche, Webb's King Red, Carter's C, Red-Chaff Squarehead, Sicilian Square-headed Red, Four-rowed Sheriff, Rimpan, Carter's G, Allora Spring, Odessa Sans-barbe, Australian Wonder, Marshall's 8, Marshall's W, Currel, Odessa, Red Bordeaux, Pool, Prince Albert, Red Provence, Willet, Spalding's Prolific, Banham Browick, McGhee's White, German Emperor, Rye Wheat, Stewart, Rye Wheat (for grain), Tuscan Island.

The above list seems to show that, so far, about 70 per cent. of our wheats are free from rust; the Durum family being the least affected, and the Purple Straw family the most. It will be interesting to watch further developments during the coming few weeks. I might say that in other respects, too, our experimental plot is at the present time of considerable interest to the agriculturist and lover of Nature. The Downs are experiencing a grand season in every respect. The undulating wheatfields to be seen in every direction present an image of abundance and plenty hardly to be surpassed anywhere in the world. Some are entirely free from rust; others are slightly affected on the flag. But, as most of the fields are sown with the early maturing and resistant Allora Spring, the heads are nearly everywhere formed and filled. It is therefore very unlikely that the rust will do great harm unless on some very rich land or low-lying, badly drained places.

Lucerne and Guinea-grass in India.

From the Department of Land Records and Agriculture of the North-west Provinces and Oudh, we have received the Sixth Bulletin of the agricultural series, dealing with the cultivation of lucerne and Guinea-grass for fodder. Three varieties of lucerne have been experimented on—the Kandahar, the Persian, and a variety cultivated at the Remount Depôt, Babugarh (Meerut). The first is a poor kind both for quantity and quality. The other two are good. The report states that the seed should be sown in ridges 2 feet apart. The advantages of ridge-sowing are thus set forth:—

1. It raises the stem of the plant out of contact with the irrigation water, as under natural conditions the plant requires very little surface moisture.
2. Weeding is much more easily performed.
3. During the rains it prevents the plant being constantly saturated with water, the furrows acting as surface drains.
4. The quantity of seed (12 lb. per acre) required is less.
5. The soil round the stems and roots of the plants can easily be loosened and kept clean by having the furrows ploughed.

At the Government Experimental Farm, Cawnpore, the experiment for determining the relative merits of sowing lucerne broadcast in furrows and on ridges has been carried on since 1893-94, and in each year the largest yield of green fodder has been obtained by sowing the seed on ridges. When a crop of lucerne is cut, the scuffler ought to be worked in the furrows to eradicate weeds and grasses, and at the same time to loosen the soil alongside the roots of the plants. After this, manure should be thrown into the furrows and mixed with the soil by means of a plough. The ridges should then be made up afresh by the ridging plough. This process should be repeated every time the lucerne is cut. If properly managed, lucerne yields in the North-western Provinces about eight cuttings in the year, the average out-turn of the green crop being about 30 tons per acre per annum. The average yield of lucerne seed per acre, under favourable conditions, is about 3 maunds.*

Guinea-grass (*P. tumentorum*).

Is considered in India one of the most valuable fodder plants, living for a number of years, if properly cultivated and cared for. It thrives best on wet soil. It is planted in rows 2 feet by 2 feet either way. The plants grow rapidly, and spread out into huge tussocks 1½ to 2 feet in diameter. The leaves and stalks may be cut down to within 6 inches of the ground. When the roots have become more than 18 inches across, so as to crowd one another, they should be split into three or four parts, and only one part left in the ground. A single cutting of Guinea-grass will yield as much as 180 maunds (about 2 tons) of green fodder per acre.

The Superintendent, Civil Veterinary Department, in his Imperial Report, says:—"The area under Guinea-grass was three-quarters of an acre. The yield was good, there being 330 maunds 23 seers (3 tons 14 cwt.)."

* 1 maund = 25 lb.

Fighting a Drought.

Droughts and floods will doubtless continue to make trouble in all countries where agricultural pursuits are carried on, excepting, perhaps, in the rainless regions of the earth, such as Peru, Egypt, &c., where heavy dews in the first case, and periodic overflowing of the Nile in the second, play the part which rain does in other countries.

As a rule, a drought is more disastrous in Queensland than a flood, and yet the former is more easily guarded against than the latter. But a very short time suffices to obliterate even the recollection of either; consequently during a series of good seasons the farmer rests in fancied security, and rarely makes the bountiful overplus of fodder supply the want of it in a dry season. How often have we heard both farmer and grazier declare that he will never be caught again by a drought—that he will set the mowing machine to work in a good season, and provide stacks of hay against a drought? How often have they done it?

Speaking at the Agricultural Bureau Congress held in Adelaide last September, the Hon. L. O'Loughlin, M.P., Commissioner of Crown Lands, said in the course of his opening address:—" While the drought that we have so recently experienced has knocked us back a few years, it ought also to teach us a valuable lesson. We have had many lessons in South Australia; we have had many droughts. I say, and my fellow-farmers say, I have no doubt, I will never be caught like this again. I will have all the hay-stacks, straw-stacks, and ensilage I can. For a few years the farmer husbands his straw, but after a while—perhaps four or five years after the drought—he does not husband his straw; he forgets the drought, and the result is that the drought comes when he is not prepared to meet it. He is caught napping again. If we experienced a drought every other year, we would doubtless be prepared to meet it. Now, I believe the recent drought will be a lasting lesson to us. With the improved systems of husbanding the straw, with the twine-binder and with the seed drills and fertilisers I spoke of, we will have better crops and be able to conduct our operations cheaper; and, moreover, we will be in a much better position to meet the droughts when they come upon us. I am sure that I am only echoing the sentiments of everyone, and certainly of every farmer in South Australia, when I say that for the future we will recognise the wisdom of saving a straw-stack every year, and of saving the cocky chaff from year to year, and not burn it as we have been doing. I think that the days have gone by when stubble should be burned." Mr. D. Wilson, of Victoria, one of the delegates to the Congress, speaking on the same subject, said:—" Droughts teach us valuable lessons, if we are ready to profit by them. . . . . Are the deaths you have suffered, and the cheques you have lost, going to do you no good? Surely you have learned by this time that when the good years come round you should get a stock of ensilage or hay, so that you will not be found shiftless again. You may talk about introducing fresh grasses. You have grasses and feed of your own if you would only use them. It is of no use telling me that a man cannot grow green stuff. I do not believe it. . . . . . . Maize will grow to 6 or 7 feet high in four months; and when that is so, why does a man say he cannot help himself when the cows die? It is a shame to say so. Make an ensilage pit and chaff your stuff into it. If next year turns out as good as this, you won't want it. Keep it by till you do want it; it is as good as money in the bank. I doubt whether a man who has a herd of cows, and half of them die on his hands after this year, ought not to be prosecuted."

Mr. Wilson, who has been a dairyman for thirty-five years, spoke straight, and he spoke from practical experience when he said that he had never made dairying pay until he made ensilage pits. The above remarks on saving feed during good seasons apply equally to us in Queensland. Some years ago the writer was compelled to sell a herd of milkers at 15s. a head during a drought, simply because in those days he had never heard of ensilage; and although the previous season had been a fair one, when the drought came there was not a blade of grass nor a lock of hay to feed to the cows, whilst the pigs were kept alive on the pulpy inside of bottle-trees.—*Editor.*

Butter Tests and Milk Trials.

Mr. Ernest Matthews (says the *London Standard*) has issued his report on the butter tests and milking trials at the recent Tring Show, an annual event now regarded with great interest in the dairy world. No fewer than 73 cows were submitted to the tests in competition for the handsome prizes offered, or more than on any preceding occasion. They consisted of 48 Jerseys, 24 Shorthorns, and 1 Welsh, and were divided into two classes—namely, for cows not over 900 lb. in live weight, and for cows over that weight. In the former class all but two of the 40 cows were Jerseys, the exceptions being a Welsh cow and a young Shorthorn; and in the latter there were 23 Shorthorns and 10 Jerseys. The milk of one day was taken for the milking trials and the butter tests. The highest milk yield in the first class was 52 lb. 3 oz., given by Lord Braybrooke's Silver Cloud III., after being 64 days in milk; in the second class it was 64 lb. 13 oz., the yield of Mr. Merry's Shorthorn, Rose, also 64 days in milk. The Jersey maximum is considerably higher than that of last year, when, however, Mr. Merry had two cows which beat the performance of Rose by nearly 3 lb., but had calved more recently. Apparently the great heat of the weather had a bad effect upon the quality of the milk, as the butter yield was not up to last year's standard. The highest yield in the first class was 2 lb. $2\frac{1}{4}$ oz., given by Lord Braybrooke's Silver Cloud III., whereas, last year, his Sundew IV. gave 2 lb. $6\frac{1}{4}$ oz. Mr. Birdsey's first prize Shorthorn, Hyacinth, gave 2 lb. $15\frac{1}{2}$ oz. of butter—the same as last year's maximum in the corresponding class. But the average butter yield of the four prize-winning Jerseys was only 2 lb. $1\frac{1}{2}$ oz., against last year's 2 lb. $3\frac{9}{10}$ oz.; and that of the winners in the heavier class was 2 lb. $11\frac{1}{4}$ oz., against 2 lb. $15\frac{1}{8}$ oz. for last year.

Milking Competition.

WIDE BAY DISTRICT.

Competition for Ayrshire Bull, D.C.A.

[Presented by the Department of Agriculture to the Owner of the Cow yielding the greatest average of Butter during the Competition.]

GYMPIE AGRICULTURAL, MINING, AND PASTORAL SOCIETY.

6TH, 7TH, 8TH OCTOBER, 1897.

Cows competing: Property of W. C. Wilson, Miva.

Date.	Name of Cow.	Milking.	Pounds Milk.	Percentage Butter Fat.	Commercial Butter.	Average for Day.
1897.					Lb.	Lb.
6 Oct. ..	Fisher ...	Morning ...	17½	4·3	0·842	Fisher 1·648
	Pansy ..	,, ...	20	5·2	1·161	
	Walnut ...	,, ...	19	3·1	0·659	Pansy 1·834
	Fisher ...	Evening ...	9	8·0	0·806	
	Pansy ...	,, ...	20	6·0	0·670	Walnut 1·339
	Walnut ...	,, ...	9	6·8	0·680	
7 Oct. ...	Fisher ...	Morning ...	20	4·1	0·918	Fisher 1·511
	Pansy ...	,, ...	20	4·3	0·963	
	Walnut ..	,, ...	17	3·2	0·604	Pansy 1·551
	Fisher ...	Evening ...	10	5·3	0·593	
	Pansy ...	,, ...	10½	5·0	0·588	Walnut 1·345
	Walnut ...	,, ...	12½	5·3	0·741	
8 Oct. ...	Pansy	Morning ...	18½	4·6	0·952	Fisher 1·223
	Walnut ...	,, ...	17½	3·3	0·647	
	Fisher ...	,, ...	15½	3·8	0·659	Pansy 1·650
	Fisher ...	Evening ...	12	4·2	0·564	
	Pansy ...	,, ...	12	5·2	0·698	Walnut 1·258
	Walnut ...	,, ...	13	4·2	0·611	

BURNETT DISTRICT.

Competition for Ayrshire Bull, Glen Elgin's Chanter.

BUNDABERG PASTORAL AND AGRICULTURAL SOCIETY.

12TH, 13TH, 14TH OCTOBER, 1897.

Cows competing: Property of Mr. M. Walker, Kalkie.

Date.	Name of Cow.	Milking.	Pounds Milk.	Percentage Butter Fat.	Commercial Butter.	Average for Day.
1897.					Lb.	Lb.
12 Oct. ...	Beauty ...	Morning ...	17¼	3·3	0·637	
	Lucy ...	,, ...	16	3·2	0·595	
	Nancy ...	,, ...	13¾	3·2	0·600	Beauty 1·481
	Beauty ...	Midday ..	9¼	5·3	0·549	
	Lucy ...	,, ...	9	5·1	0·514	Lucy 1·497
	Nancy ...	,, ...	10¼	5·2	0·596	
	Beauty ...	Evening ...	8½	3·2	0·295	Nancy 1·482
	Lucy ...	,, ...	8¼	4·2	0·388	
	Nancy ...	,, ...	8¼	3·1	0·286	
13 Oct. ...	Beauty ...	Morning ...	16½	2·8	0·520	
	Lucy ...	,, ...	15½	3·1	0·538	
	Nancy ...	,, ...	16	3·0	0·537	Beauty 1·493
	Beauty ..	Midday ...	10½	4·2	0·493	
	Lucy ...	,, ...	10	3·9	0·436	Lucy 1·411
	Nancy ...	,, ...	10½	4·4	0·517	
	Beauty ...	Evening ...	10	4·0	0·480	Nancy 1·458
	Lucy ...	,, ...	8½	4·6	0·437	
	Nancy ...	,, ...	9½	3·8	0·404	
14 Oct. ...	Beauty ...	Morning ...	17½	3·1	0·607	
	Lucy ...	,, ...	15	3·6	0·604	Beauty 1·256
	Nancy ...	,, ...	17	3·8	0·533	
	Beauty ...	Evening ...	14½	4·0	0·649	Lucy 1·256
	Lucy ...	,, ...	13¼	4·4	0·652	
	Nancy ...	,, ...	14	4·2	0·658	Nancy 1·191
			Total for Three Days.			
	Nancy ...	...	...	...	4·131	
	Lucy ...	...	...	...	4·164	
	Beauty ...	...	...	...	4·230	

Cows competing: Property of Mrs. Greathead.

Date.	Name of Cow.	Milking.	Pounds Milk.	Percentage Butter Fat.	Commercial Butter.	Average for Day.	
1897.					Lb.		Lb.
12 Oct. ...	Buttercup ...	Morning ...	17	3·0	0·590	Buttercup	1·169
	Dairymaid ...	" ...	15½	3·1	0·537		
	Polly ...	" ..	15	3·1	0·520	Dairymaid	1·005
	Buttercup ...	Evening ...	11¼	4·6	0·579		
	Dairymaid ...	" ...	11	3·8	0·468	Polly	0·923
	Polly ...	" ...	11½	3·2	0·403		
13 Oct. ...	Buttercup ...	Morning ...	16½	3·0	0·554	Buttercup	1·114
	Dairymaid ..	" ...	17	2·8	0·533		
	Polly ...	" ...	17½	3·0	0·585	Dairymaid	1·038
	Buttercup ...	Evening ...	12½	4·0	0·560		
	Dairymaid ...	" ..	11	4·1	0·505	Polly	1·145
	Polly ...	" ...	12½	4·0	0·560		
14 Oct. ...	Buttercup ...	Morning ...	17	3·2	0·609	Buttercup	1·165
	Dairymaid ...	" ...	17	3·2	0·609		
	Polly ...	" ...	17½	3·0	0·588	Dairymaid	1·079
	Buttercup ...	Evening ...	11	4·6	0·566		
	Dairymaid ...	" ...	10⅓	4·0	0·470	Polly	1·000
	Polly ...	" ...	11⅓	3·2	0·412		

Cows competing: Property of Mr. Archer.

Date.	Name of Cow.	Milking.	Pounds Milk.	Percentage Butter Fat.	Commercial Butter.	Average for Day.	
1897.					Lb.		Lb.
12 Oct. ...	Ida	Morning ...	12	3.4	0·456	Ida	0·832
	Blossom ...	" ...	11¼	4·0	0·504		
	Darling ...	" ...	13½	3·0	0·453	Blossom	0·903
	Pansy ...	" ...	12½	4·0	0·560		
	May... ...	" ...	13¼	3·3	0·489	Darling	0·757
	Isabel ...	" ...	13	3·3	0·480		
	Ida	Evening ...	8	4·2	0·376	Pansy	0·920
	Blossom ...	" ...	7½	4·4	0·339		
	Darling ...	" ...	8½	3·2	0·304	May	0·808
	Pansy ...	" ...	7	4·6	0·360		
	May... ...	" ...	7½	3·8	0·319	Isabel	0·748
	Isabel ...	" ...	7½	3·2	0·268		
18 Oct. ...	Ida	Morning ...	12½	3·2	0·448	Ida	0·868
	Blossom ...	" ...	12	3·3	0·443		
	Darling ...	" ...	13	3·1	0·451	Blossom	0·801
	Pansy ...	" ...	12	3·1	0·414		
	May... ...	" ...	13	3·0	0·436	Darling	0·738
	Isabel ...	" ...	13¾	3·2	0·459		
	Ida	Evening ...	8½	4·0	0·380	Pansy	0·826
	Blossom ...	" ...	8	4·0	0·358		
	Darling ...	" ...	8½	3·4	0·323	May	0·835
	Pansy ...	" ...	8	4·6	0·412		
	May... ..	" ...	8½	4·2	0·399	Isabel	0·772
	Isabel ...	" ...	8½	3·3	0·313		
14 Oct. ...	Ida	Morning ...	13	3·6	0·524	Ida	0·876
	Blossom ...	" ...	12½	3·7	0·517		
	Darling ...	" ...	14	3·4	0·527	Blossom	0·893
	Pansy ...	" ...	12½	4·0	0·560		
	May... ...	" ...	13	4·0	0·535	Darling	0·958
	Isabel ...	" ...	15	3·8	0·638		
	Ida	Evening ...	7½	4·2	0·352	Pansy	0·920
	Blossom ...	" ...	8	4·2	0·376		
	Darling ...	" ...	8½	4·6	0·431	May	0·801
	Pansy ...	" ...	7	4·6	0·360		
	May... ...	" ...	7	3·4	0·266	Isabel	0·857
	Isabel ...	" ...	7	2·8	0·219		

The above is from the Report of Mr. John Mahon, Government Dairy Expert, who superintended the competitions.

Effect of Fatigue on Milk Production.

UNDER the heading "Agricultural Chemical Notes," the *Scottish Farmer* has the following article on investigations on the effect of fatigue on the quality and quantity of the milk yielded by cows, which were carried out during this year by Dr. C. M. Aikman at the Vermont (U.S.) Experiment Station:—

Seventeen cows were purchased by the station and driven about ten miles, transported by rail for fifty miles, and finally driven a mile and a-quarter, having thus been on the road all day. A second lot was purchased and transported under exactly similar conditions. The yield and composition of the milk was determined on the night of arrival, the following morning, some days later, and at the end of two weeks, the following figures being given:—

	Milk Yield.	Total Solids.	Fat.	Solids not Fat.
	Lb.	Per Cent.	Per Cent.	Per Cent.
FIRST LOT—				
Night of arrival	7·5	14·95	5·45	·50
Morning after arrival	7·4	16·70	7·28	9·42
Two weeks after arrival	8·8	13·90	4·55	9·35
SECOND LOT—				
Night of arrival	8·8	14·10	5·04	9·06
Morning after arrival	11·0	14·98	5·90	9·08
Two weeks after arrival	12·7	14·14	4·88	9·26

From these it will be seen that the amount yielded was lessened by fatigue, the general quality improved, and a decided increase manifested in the fat. It was also noted that half of the cows gave richer, and half essentially the same amount of poorer milk on the evening of the day of travel as they gave after recovery from fatigue. All gave richer milk the morning following the travelling than they did two weeks later. The greatest variation was shown in the fat, the solids not fat, remaining almost uniform.

The effect of heavy exercise on milk production has also been investigated by Henkel, who came to the conclusion that moderate exercise exerted a favourable influence on the quantity and quality of the milk, while heavy fatigue diminished both the quantity and the quality of the milk. The experiments were carried out by driving a number of cows a considerable distance, in some cases up a mountain, and analysing the milk for some days before and after the trip. It was found that heavy exercise diminished the yield and also the absolute amount of milk constituents. This decrease was more or less noticeable in the first milking after the trip, according to the severity of the exercise, but was more pronounced in the second milking. The amount of water decreased in the first milking, more in the second milking, and then gradually sank to the normal. The percentage of fat was greatly increased in the first milking, according to the severity of the exercise; was still greater in the second milking, and then gradually sank to the normal. The casein increased in the first milking, remained about the same in the second milking, and then gradually returned to the normal. The milk-sugar decreased in the first milking, and usually rose again to the normal in the second and following milkings. The ash constituents were decidedly higher in the first milking after the trip, but sank to the normal then. It has been asserted that the acidity of milk is greater after exercise, but such was found not to be the case.

The Origin of the Ayrshire.

Mr. John Speir, writing to the *Scottish Farmer*, says:—"The Theophilus Paton, of Ayrshire fame, died at the age of ninety-eight or ninety-nine somewhere about eighteen years ago. I spent a great deal of time in the old man's society. The origination of his Ayrshire herd and that of Mr. Parker was an oft-repeated story of his. His version of it was, that his herd sprang from a Highland cow which his brother Will, who was a Highland cattle-dealer, had purchased somewhere in the West Highlands. That brother died forty years ago. The cow was mated with an Ayrshire bull, and the progeny was not only the nucleus of what turned out to be his famous Ayrshires, but also of those of Mr. Parker, of Broomlands, Irvine. It was about Mr. Parker's time, forty years ago, that the upturned horns came into fashion; but whether or not Mr. Paton's cow had anything to do with that, I am not in a position to say."

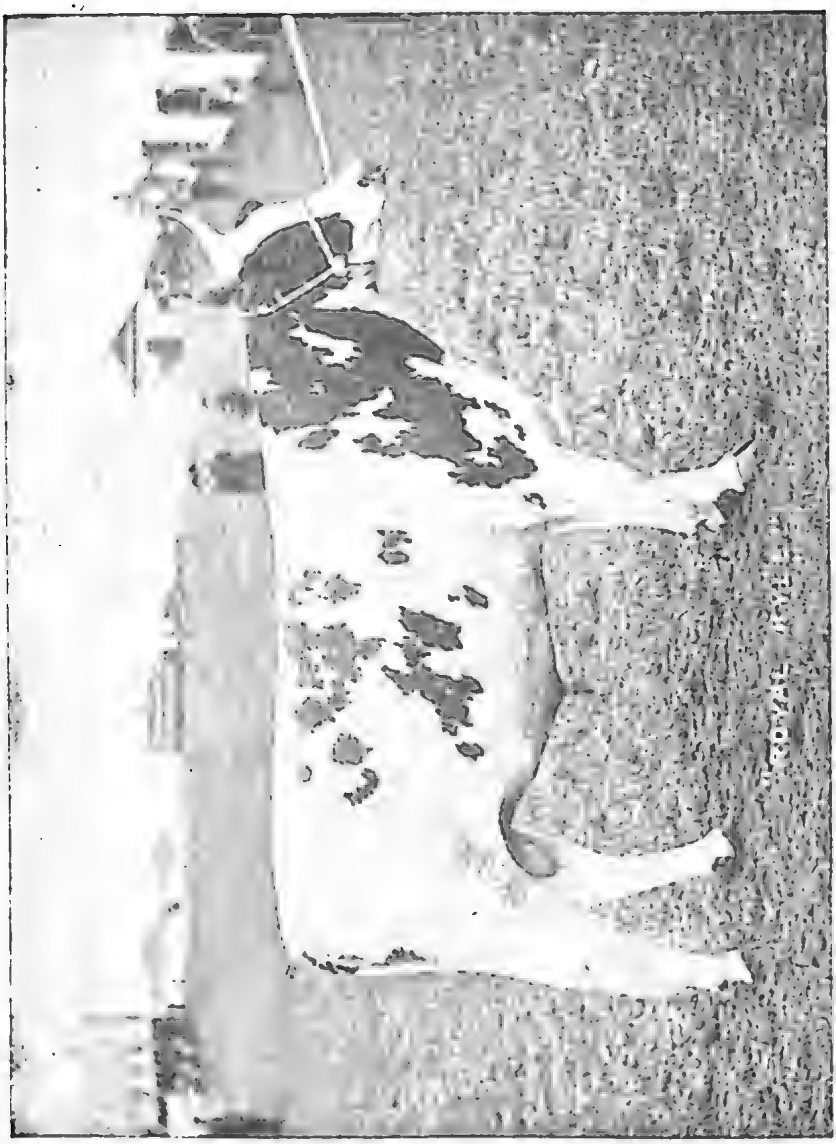
Mr. Stewart, of Eagle Farm Dairy, who has an intimate knowledge of dairy cattle, and who visited several Ayrshire herds in Scotland last year, says that he is quite of the opinion that the Highland cow is responsible for the upturned horns.

SOME PRIZE AYRSHIRES.

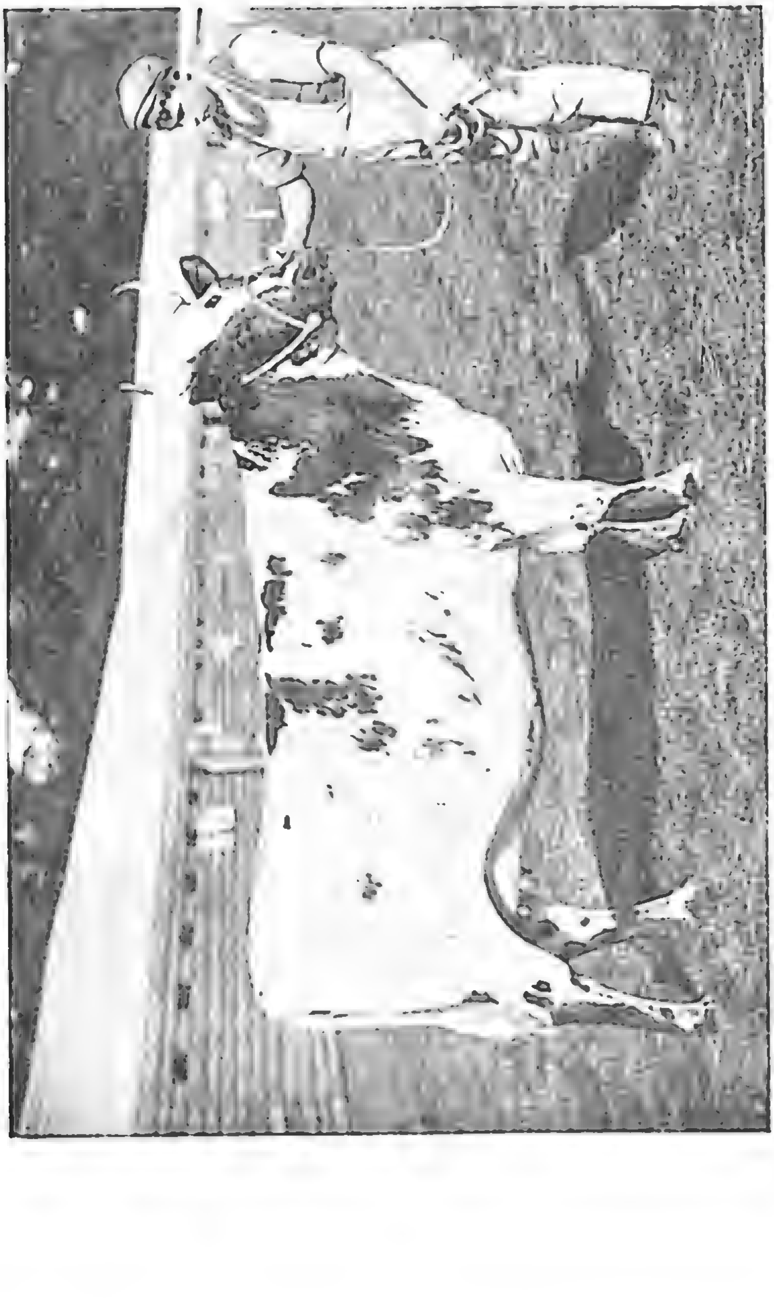
We have received from Mr. J. Stewart, of Eagle Farm, photographs of some pure-bred Ayrshires, which we reproduce in this issue. No particulars are given of them beyond what is stated on the photographs, but they are well worthy of being studied, as it is claimed they show all the points of that justly celebrated breed, and thus are of value for comparison with our own herds. The photographs were taken in Scotland last year, and brought to Queensland by Mr. Stewart.

BRIGHT SMILE, at 4 Years.
The property of Mr. Holm, Japston, Neilston.

WHITE COCKADE.



ROYAL KYLE.



6th DERBY POLLY.

6th Ayr Derby, 1895; 2nd Uncalved, Highland, Perth, 1896.

JUDY.

1st Ayr Derby, 1895; 1st Cow in Milk and Champion, Highland, Perth, 1896.

Destruction of Native Birds.

We have received from Mr. William Main, hon. secretary of the Runcorn and Cooper's Plains Fruitgrowers' Association, the following report of the first meeting of that body. Although the report has already been published in the *Courier*, we deem the subject of sufficiently grave importance to give it still further publicity in the *Journal*. The thanks of all fruitgrowers are due to those who are endeavouring to preserve birds whose insect-eating proclivities make them most valuable co-operators with orchardists:—

The first meeting of the newly formed Runcorn and Cooper's Plains Fruitgrowers' Association was held in the United Protestant Church, Runcorn, on Saturday evening, 9th October, when there was a good attendance. Mr. Alfred Williams, J.P., chairman of the Yeerongpilly Board, presided, and addressed the meeting on the subject of the Native Birds Protection Act. He pointed out that Sunday shooting was becoming a perfect nuisance in all the districts around Brisbane, and that fruitgrowers were in danger of being deprived of their best friends, the insectivorous birds. On a recent Sunday he found a ship's company, from a large vessel in the Brisbane River, marching through his grounds and shooting at everything they saw. When spoken to by him they politely said they were not aware that there was a law in force against the unnecessary use of firearms on Sunday, nor that the native birds were protected. This was only one instance of many; for not a Sunday passed without shooting parties of a similar kind destroying little birds—a destruction that it would take years to rectify, for it was found that once the birds are frightened away from a district they are very slow in returning. There were many places around Brisbane where there were scarcely any small birds left, in spite of the law. The other day he had drawn the attention of a policeman to a boy who was actually carrying protected birds along Stanley street, but that official either did not know the law or had no instructions to act. He strongly urged the members of the association in their various neighbourhoods to support him in putting a stop to this nuisance of Sunday shooting, which was so evidently destroying the best natural protection fruitgrowers had from the insects that, when not kept down, made the growing of good fruit an impossibility.

Dr. Lucas, who followed Mr. Williams, strongly supported him in all he had said, and referred more particularly to the trapping and sale of finches, which, as insect-destroyers, were the most valuable friends of the fruitgrower. He also gave an instance of a "sporting" party who endangered his fence by lighting a fire, and, when challenged, said they were doing no harm, and had a perfect right to shoot on Sunday. He moved,—"That the divisional boards and the Agricultural Department be written to, and requested to do all they can to prevent the infringement of the laws, which are now all but unknown, and certainly not in force." He hoped that other societies would move in the matter, and bring about a better state of things in the immediate future.

Mr. Williams said he felt so strongly in this matter of bird protection that he was prepared to give a reward, in addition to any sum that might be voted from the funds of the association, for information that would lead to conviction of anyone infringing the law prohibiting unnecessary Sunday shooting, and the killing and trapping of protected birds.

The motion was carried, and the meeting adjourned.

Our Botanic Gardens.

By PHILIP MacMAHON,
Curator.

To enter our Gardens at Brisbane, and to see so many different plants from so many remote parts of the earth—remote as regards our own country, and still more so as regards each other—is to set one thinking. One thinks that the climate which can grow the products of so many lands must have much to recommend it as a place of abode for man. One thinks, too, that there is a great future before a country with such a climate and such a soil. Then one is insensibly led to look with admiration upon the whole plant world so beautifully shown no less in the humblest herb than in the tall and stately palm; and having paid this natural tribute to the excellence of Nature, one begins to think that each of these must have some use, some virtue, which is known to those whose life business it has been to look upon them daily. You feel that you would like to know something more about them than the bald statement conveyed on a label, which; like the labels on the bottles in a chemist's case, gives no hint of the possibilities within.

Let us walk in our Gardens from month to month through the medium of this *Journal*, and let us see if we cannot learn something of the inner life of these graceful living forms. We may find much to learn as to how they minister to the needs of man, what their value is as the world goes to-day, their special uses to our own people and to those of other nations.

Let us talk in simple language which the artisan and labourer can understand; and if there is anything you want to know further, a postcard to the Editor will procure for you the information when we have our next talk.

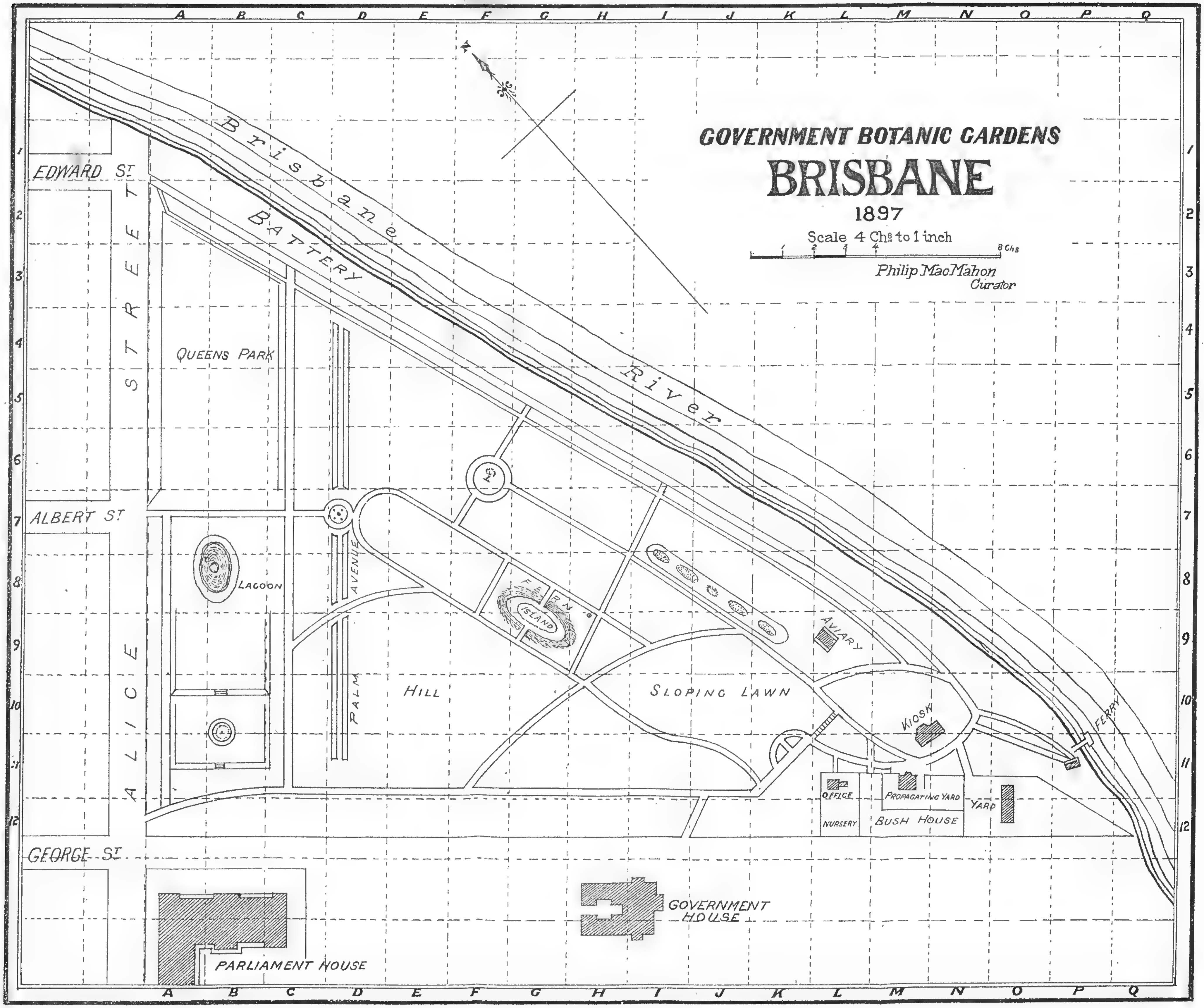
At the outset, to make things clear, and to avoid useless repetition, it may be as well to say that we shall have to lay many people under contribution for the materials of our conversations. The publications of our veteran Colonial Botanist,* whose name is known and honoured the world around wherever a botanist examines a plant; of Baron F. von Mueller, whose gloriously unselfish career has just closed; of Maiden, Moore, Bernays, Schlich, Nicholson, Gamble, Roxburgh, Smith, Henslow, Schomburg, Fawcett, and many others.

Nothing would please them better than that we should use their labours. That is why they laboured. Reports which are constantly coming in from all quarters of the earth will, too, be drawn upon; in fact, any information to hand will be used, if it be only interesting, new, and useful.

But when a plant is mentioned here, you cannot go rambling about all day in the hope of finding it in the Gardens. With this issue is presented a lithographed plan which will greatly limit the area of your search. You will find that it is divided into parallel spaces, and that at the top and bottom are letters and at the sides figures. When any plant is talked of, a number and figure will be given if necessary, and this will fix the position. You have simply to find the letter at the top and follow that column down till you come to the cross column shown by the figure, and the thing spoken of is in that space, which is exactly 44 yards by 44 yards on the ground.

Some prominent plants we may pass without speaking of, because it may not be the best time to speak of them, and we may have to hurry off to a distant part where there is something useful or interesting in bloom, but our little map will always keep us right. Have it mounted on a piece of linen and take it into the Gardens, and make yourself used to identify the local features. The rest comes easy.

* F. M. Bailey, F.L.S., &c.


GOVERNMENT BOTANIC GARDENS
BRISBANE
1897
Scale 4 Chs to 1 inch
8 Chs
Philip MacMahon
Curator
Brisbane River
BATTERY
EDWARD ST
ALBERT ST
GEORGE ST
ALICE STREET
QUEENS PARK
LAGOON
PALM AVENUE
HILL
FERN ISLAND
SLOPING LAWN
AVIARY
KIOSK
FERRY
OFFICE
NURSERY
PROPAGATING YARD
BUSH HOUSE
YARD
GOVERNMENT HOUSE
PARLIAMENT HOUSE
A B C D E F G H I J K L M N O P Q

Like most visitors, particularly those from a distance, you enter the Gardens by the George-street entrance, opposite the Queensland Club (A. 12), and you are at once amongst an array of plants from different zones. To your left is the Logwood from the coast lands of Honduras, in a corresponding latitude to that of Princess Charlotte Bay (N. Queensland). In front waves a tall *Cocos plumosa* Palm from South Brazil; a little further on to the left a Date Palm from the Arabian Desert. Away to the left wave the graceful Bamboos of the East, and between we catch glimpses of water in which grow in great profusion the papyrus, upon which the achievements of the ancient kings of Egypt were inscribed. Wildfowl of Queensland splash and dive between. Pines from temperate regions and trees from Canada stand near the *Acalyphas* and *Dracænas* of the islets of the Pacific, and a *Poinciana* from Madagascar waves its feathery leaves amongst the branches of the Cluster Fig of Queensland.

The Logwood takes our attention first; we have better specimens in our Gardens than this one. Every year the civilised world uses logwood to the value of £2,000,000, and the best dyeing authorities are of opinion that aniline dyes can never drive it from the market. "Why don't you grow logwood?" said a New Zealand man the other day, when he saw our trees, "we pay large sums for it in New Zealand."

From the Logwood grown in our Gardens, dye has been prepared by Mr. Drury, dyer, Valley; and he considers it as good as any he has ever used, if not better. It grows, flowers, and seeds freely here. The seedlings come up in the borders, grass, everywhere. If persons having business in our humid scrubs would take a pocketful of this seed and scatter a pinch in rather open spots, there can be no doubt that this distinctly valuable tree would become naturalised, and be most useful for export purposes in a few years.* This is what has taken place in Jamaica. There are several varieties of Logwood even in its native forests. The cutters of Yucatan recognise four by name, though, from a botanist's point of view, they are all the same. Its use is comparatively ancient. In the twenty-third year of Queen Elizabeth an Act was passed to prohibit its use, because the colour "ran." This was repealed 100 years later. Messrs. Knecht and Rawson, in their manual of dyeing, call it the most important of all dyestuffs.

On 1st June, 1896, the price of Logwood in Europe was:—Mexican, Laguna Prima, £12 per ton.

The importations into Europe of recent years have been—

1892	180,958 tons
1893	188,664 ,,
1894	208,185 ,,
1895	225,779 ,,

Besides which the United States take about 75,000 tons a year.

The branches are brittle, and for that reason it does not make a good tree for open planting. Those who have "Dampier's Voyages" will find at vol. 2, part 2, p. 56, ed. 1729, a very interesting account of the adventures of the logwood-getters of those days.

A specimen of the Moreton Bay Fig (*Ficus macrophylla*), with which we are all familiar, stands a little distance to the right. What we may not all know perhaps is that the foliage of this tree is eagerly sought by cattle, with whom it seems to agree very well. In India, elephants and cattle are regularly fed on it; and Mr. Maiden notes that when the trees in the Outer Domain, Sydney, are pruned, the cattle leave their accustomed pasture and devour every newly sprouting leaf which they can get at. An appreciable amount of India-rubber is to be found in this tree. It is a sister of the Assam rubber-tree, which we shall meet with by-and-by.

* This is a suggestion worth noting.—Ed. *Q.A.J.*

This tree is a favourite for shade, but should never be planted in a garden, as its roots travel almost on the surface of the ground to surprising distances, and there is no mercy for the poor plant of less hardy growth into whose little plot these octopus roots come. You may manure as much as you like—the fig requires it all; you may cut off the roots, but, like the Hydra of Grecian legend, others spring up in the place of the one you sever. If planted too near houses, the roots insinuate themselves into drains, which they speedily choke.

You may like to know how these trees establish themselves in the lofty forests where the seedlings would be smothered if they grew in the usual way.

In the Fern Island (G. 9) there is a palm 50 feet high; and four years ago, a bird left a tiny fig-seed in a cranny in the top of the palm, and in due course a little seedling made its appearance. It was such a green, innocent little thing that no one would refuse it shelter, and it sent out rootlet after rootlet; and now the advanced guard of these rootlets are within a foot of the ground, and will soon enter it. Then they will begin to thicken up and become quite woody, and the days of that palm will be numbered. It is a case of slow murder under cover of hospitality. There is another example—near the private entrance to Government House Grounds (I. 12). But here the insidious guest has been at work for nine years, and strong bands woven around the host (a wattle) are thickening fast and gripping cruelly.

To the left as you enter, there stands a Silky Oak (*Grevillea robusta*). It is not our best specimen, but it is in flower just now, and a very beautiful flower it is, and a very useful tree it is that bears it. Take a branch, and when you have admired the way in which all the bunches (racemes) of flowers spread out so as not to interfere with each other's daylight, you will find much to admire in the flowers themselves. See how they all develop from the base of the bunch upwards. At first there is just a little green tube with a knob on the top. Then the style, as it is called, begins to grow, and grows so much faster than the rest of the flower, that presently the tube is broken near the bottom, but keeps a firm grip of the top of the style, which keeps on growing till it forms a loop which acts as a kind of spring to jerk up the style when the hold is relaxed. About this time, but not before, honey is secreted very freely, and bees come in crowds and jostle each other, and carry the pollen from one flower to another and so secure cross-fertilisation. It is most interesting to trace this development. We might have worse employment. You will note, too, that at the time when the Silky Oak is in flower, a large number of the birds called leatherheads invade the Gardens and make a cheerful medley of sound with their peculiar notes. Of the order to which this tree belongs, all noted for the curious arrangement of their floral parts, there are about 1,000 species, and they hark back to very ancient times too, as some have been found in a fossil state, in the tertiary deposits, co-eval with some of the extinct animals whose bones you will find in our Museum. The timber is good for staves, and, being very prettily marked, is very good for cabinet-work. It is very largely planted in India; indeed, it is a question if there are not many more silky-oak trees in India than there are in Queensland.* A gum which exudes from it is said to have a chemical reaction different from any gum at present known, and to be as useful for adhesive purposes as gum arabic.

Still in the same square (A. 12) stands a plant of a graceful Palm, *Cocos plumosa*. It is one of the hardiest and most free-growing of palms. Let us call it the Feather Palm. There are about 1,100 distinct palms in the world, about one-fourth of the entire number of known species of plants of all sorts in Queensland, including grasses, mosses, ferns, and fungi. This Palm will grow in any garden, seeds freely, and can be easily raised in any quantity. It will grow anywhere in Brisbane, and if it were freely planted in suitable positions the city would soon have a beautiful and distinctive appearance, and might be known as the "City of Palms." Walk now straight along, passing several objects of interest on the way, till you come to where the ground

* There are to-day more Silky Oaks standing in our gardens and streets than can be found in the yet standing scrubs.—Ed. *Q.A.J.*

begins to dip down towards the large clump of Bamboos. Our position now is F. 11 on the map. From here a very pretty view is to be had; but let us look at a plot of grass to the right in F. 12. This is "Para-grass" (*Panicum muticum*). It is a famous fodder grass; will flourish in damp and even wet places; and will succeed in a dry place, as on this ridge. In Florida it is cultivated on high pine ridges. It grows from every bit of the stem, and after a very short time takes possession, and then no weed, not even nut-grass, has the smallest chance against it. It has exterminated nut-grass on the small plot where it grows. In Jamaica, they find that it will smother out any weeds, and in a recent report from that island it is stated to be one of the most valuable of grasses. According to the Kew authorities, it is stated that, in Barbadoes, forty acres of Para-grass, well manured and irrigated, yielded in good years cut grass of an annual value of £600 (*Kew Bulletin*).

In Ceylon, the natives grow it largely as a fodder grass. In a damp place it is always green, and will bear cutting often.

At Poona, in India, the following is the yield of two cuttings at intervals of eighty-seven days on ordinary land:—

	Yield per Acre.
First cutting	10,700 lb.
Second cutting	18,020 lb.

This grass is interesting as being one of the very first plants sent out about fifty years ago to several colonies by the Kew authorities, a work which they have continued ever since with magnificent and far-reaching results. To propagate in quantity, chop up the stems, scatter them over the ground, and lightly fork in or scatter good earth lightly over; then roll. Keep clean for a time, and you will have no further trouble. This grass is a capital crop to irrigate for fodder. When you see it, the young leaves will probably be pushing, for it is now being cut down.

Next month we will continue our talk. There is plenty of material.

Botany.

CONTRIBUTIONS TO THE FLORA OF QUEENSLAND.

By F. MANSON BAILEY, F.L.S.,
Colonial Botanist.

Order LEGUMINOSÆ.

ERYTHRINA, Linn.

E. phlebocarpa, *Bail.* (n. sp.). (Name from the prominent veining on the pods.) Deciduous tree; branchlets thick and more or less covered with small black prickles. Petioles nearly terete, about 8 in. long, unarmed. Leaflets 3, membranous, the terminal one often 7 in. long and 8 in. broad, on a petiolule of about $\frac{1}{2}$-in. at the end of a rhachis of about $2\frac{1}{2}$ in., rhomboidal in form; the lateral leaflets smaller but very similar in form, on petiolules of about $\frac{1}{2}$-in. Stipellæ gland-like. Peduncles terminal, stout, unarmed or a minute prickle or two near the base, 5 or 6 in. long, or with the raceme sometimes 15 in. Flowers crowded, red, usually in whorls of 4 upon the rhachis, the whorls scarcely $\frac{1}{2}$-in. apart. Pedicels 4 lines long. Calyx campanulate, oblique at the top, about 6 lines long, marked with longitudinal lines. Standard 2 in. long, slightly recurved, tapering towards the base, about 7 or 8 lines broad when expanded, but usually infolded and so appearing narrower, apex acuminate; wings and keel petals oblique-oblong, about as long as the calyx. Pod 1 or 2 seeded, 3 to 5 in. long, about 1 in. broad over the seeds, much constricted between them, with a long seedless base and long acuminate apex; the exocarp marked on the outside by strong reticulate veins, endocarp separating from the exocarp and long retaining the seeds. Seeds oblong, red, 7 lines long, 4 lines broad, flat on the bottom or hilum side, and showing a rather sharp longitudinal ridge on the upper side. Allied to *E. indica*, Linn.

Hab.: Newcastle Bay, Cape York Peninsula, *Frank L. Jardine.*

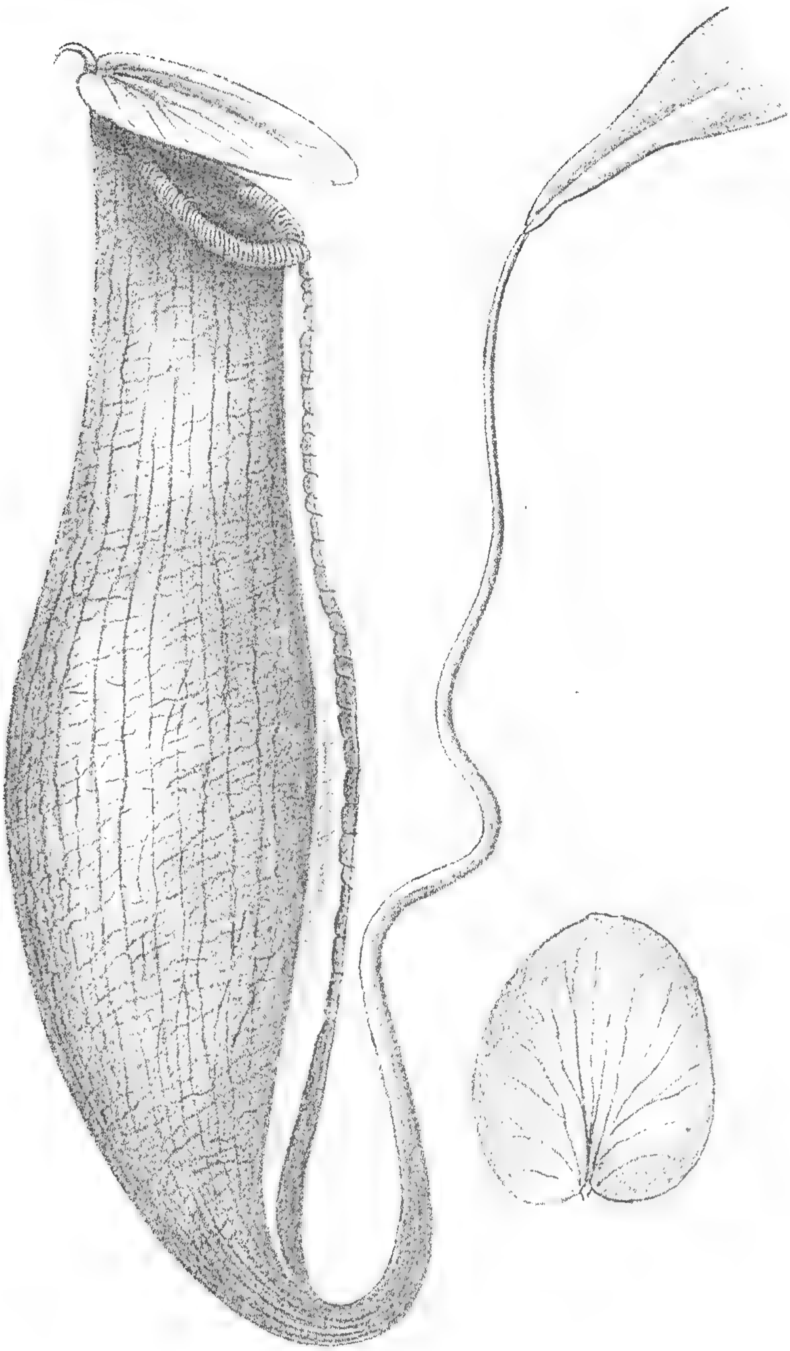
Order APOCYNACEÆ.

ALSTONIA, R. Br.

A. somersetensis, *Bail.* *Queensland Agricultural Journal*, Sept., 1897. From specimens to hand from Mr. F. L. Jardine, of Somerset, I am enabled to add the following to the description already published:—

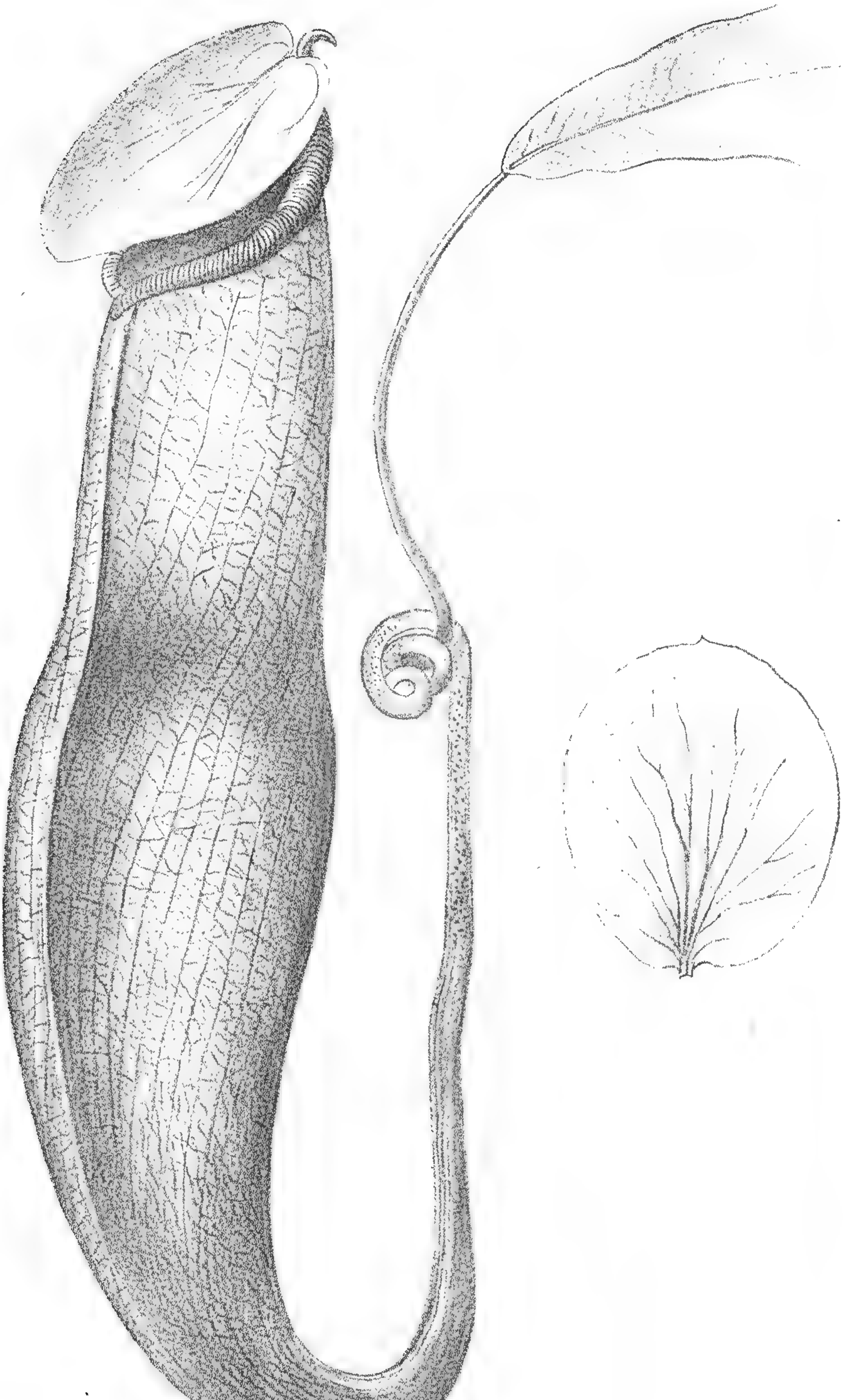
Flowers white in pedunculate cymes, generally from 6 to 8 at extremities of the branchlets. Peduncles from 1 to 2 in. long, angular and hoary pubescent. Cymes trichotomous. Bracts minute, ovate-lanceolate, ciliate. Calyx-segments thick, much imbricate, obtuse, pubescent, the keel prominent, about 1 line long and nearly as broad, without glands inside at the base. Corolla-tube twice as long as the calyx, longitudinally corrugated, tomentose except at the base, lobes rather broad, not quite as long as the tube, densely covered on the face with white curly hairs, no ring of hairs at the orifice, but a rather broad band of short hairs below where the anthers are attached to the tube. Ovary glabrous. Follicles 10 to 15 in. long. Seeds flat oblong, covered on both faces with short brown hairs, and ciliate with long bright-brown hairs, which at each end exceed in length that of the seed itself.

It is probable this tree might yield a rubber, this material being obtained from other species of the genus.



F. Wills, del. Fred Elliott, Lith.

Nepenthes Bernaysii, *Bail*



Wills. del.

Fred Elliott, Lith.

Nepenthes Kennedyi F.v.M.

Order NEPENTHACEÆ.

(THE PITCHER-PLANT FAMILY.)

NEPENTHES, Linn.

Table showing the differential characters of the Australian species:—

Stems long, climbing. Pitchers inflated below the middle, without any crest on the anterior ribs; the naked portion of costa forming a curl about the middle	*N. Kennedyi.*
Stems short, climbing. Pitchers inflated below the middle, the anterior ribs winged with distant coarse ciliæ or weak bristles along their margins; naked portion of costa without a curl	*N. Bernaysii.*
Stems not climbing. Pitchers inflated below the middle, anterior ribs with a narrow non-crested wing; naked portion of costa without a curl	*N. Jardinei.*
Stems stout, not climbing. Pitchers enlarging from the base upwards, thus forming a wide orifice; the anterior ribs with scarcely any wing; naked portion of costa without a curl	*N. Rowanæ.*

N. Rowanæ, *Bail. Queensland Agricultural Journal*, 1st September, 1897, with plate showing pitcher. From specimens to hand from Mr. F. L. Jardine, of Somerset, I am enabled to add the following to the already published description:—

Stems stout, erect, 2 or 3 ft. high, hoary tomentose. Leaves numerous, coriaceous, prominently decurrent upon the stem, falcately recurved, tapering towards the base into a broad petiole, including this tapering base or broad petiole about 11 in. long, the broad centre about $1\frac{1}{2}$ to $2\frac{1}{2}$ in. wide; longitudinal nerves 6 on each side of costa, the cross-veins wavy but not very prominent from the thickness of the lamina, the naked portion of costa or stalk of pitcher somewhat flattened, 7 to 10 in. long, without a curl, straight and cane-like. No flowers or fruit yet to hand.

The two specimens sent by Mr. Jardine as *Nepenthes Kennedyi*, in the box with *N. Rowanæ*, proved to be *N. Kennedyi* and *N. Bernaysii*. With these specimens were also, in a separate paper labelled *N. Kennedyi*, three specimens of male inflorescence; but as Mr. Jardine placed the two species above mentioned as *N. Kennedyi*, I cannot say to which they may belong. The peduncles of these are most certainly not attached to the stem, like I found those of the female inflorescence of that species, and described in Syn. Ql. Flora; and up to the present no male inflorescence has been described. I am inclined to consider those now forwarded by Mr. Jardine as belonging to *N. Bernaysii*, of which neither inflorescence is known, and under which species a description is here given provisionally:—

N.? Bernaysii, *Bail.* Peduncles 4 to 6 in. long, shortly tomentose, more or less plainly striate. Raceme 5 to $7\frac{1}{2}$ in. long, flowers (male) rather crowded. Pedicels slender, 5 lines long, tomentose. Perianth with 4 reflexed oblong-cuneate segments, about half as long as the pedicels, glabrous and dark-coloured on the face, tomentose on the back. Staminal column about as long as the segments; head of anthers about $\frac{3}{4}$-line diameter.

Order PROTEACEÆ.

CYANOCARPUS, Bail.

C. Cribbiana, *Bail.* (n. sp.) (Named in honour of Mr. J. G. Cribb, the Queensland amateur pomologist, to whom we are indebted for the introduction of many varieties of fruits.) A glabrous tree about 20 ft. high Leaves oblong to oblanceolate, 3 to 7 in. long, entire on all the specimens to hand, often clustered at the ends of the branchlets, particularly the branchlets which form long internodes, thin-coriaceous, tapering from above the middle to a petiole of 3 to 6 lines, the apex abruptly-acuminate; primary veins distant, and the finer reticulation faint on both sides. Racemes 2 to 4 in. long (only seen in fruit). Fruit oval, red, about 1 in. long, pedicel about 2 lines, exocarp fleshy, endocarp thin, almost cartilaginous.

Hab.: Mourilyan district, *E. Cowley*, Sept., 1897.

Now that the fruit is known, two out of the four species of *Helicia*—viz., *H. glabriflora* and *H. ferruginea*—given in the 5th vol. of the "Flora Australiensis," have to be removed into *Cyanocarpus*, as their drupe-like fruits have a soft juicy exocarp and a cartilaginous endocarp. The genera *Helicia*, *Macadamia*, and *Cyanocarpus* might all be included in one genus; but while *Macadamia* is retained we require *Cyanocarpus* for the soft juicy fruited kinds.

Order URTICACEÆ.

FICUS, Linn.

F. scandens, *Roxb.*, **var. australis** (n. var.) Described by collector as a tall, woody climber. Bark on branchlets ribbed and of a rusty colour. Leaves alternate on rather slender petioles of about 5 or 6 lines, ovate to ovate-oblong, 2 to nearly 4 in. long, shortly acuminate and rounded at the base. Primary veins distant, about 5 or 6 pairs, the basal ones far distant from the others; the smaller veins or reticulation rather obscure, particularly on the underside, from a very close covering of ferruginous scales or short pubescence, which under a lens has a tesselated appearance. Receptacles axillary, solitary or in pairs, on peduncles about 1 line; globose, ½-in. diameter, forming at its base a slender stipes of about 2 lines; the lower half of the globular portion with 5 or more ribs; the whole covered with very short ferruginous glandular scales or hairs; orifice umbilical, the branch near the orifice rather large and slightly jagged at the end. No male florets in the receptacles examined. Perianth-segments 3, oblong, of unequal length, slightly ribbed on the lower part, fleshy and of a deep red, achene oblong-smooth with a rather prominent margin, style elongated, infra-apical, rather flattened, constricted below the long straight stigma. I found some galls near the orifice, which were white, large, and globose, with a terminal nearly sessile flag-like stigma; besides these the usual galls are met with near the centre of the receptacle.

Hab.: Range about Kamerunga, *L. J. Nugent.*

The present plant differs but little from *F. scandens*, Roxb., as described by Dr. King and others. The segments, however, of the perianths I find are only three; the receptacles also are stipitate on very short peduncles.

Order FILICES.

ASPLENIUM.

A. nidus, var. multilobum (n. var.) This differs from the normal form in having its fronds much lobed for three parts of their length. Many of the lobes are over 6 in. long, and often themselves more or less lobed. (See illustration.)

Hab.: Range near Kamerunga, *L. J. Nugent.*

ASPLENIUM NIDUS, Var. *MULTILOBUM.*

LIQUORICE—*GLYCYRRHIZA GLABRA*, LINN.

Economic Botany.

No. 3.

LIQUORICE (*GLYCYRRHIZA GLABRA*, Linn.)

By J. F. BAILEY.

Derivation.—From the Greek *glykys*, sweet, and *rhiza*, a root: *glabra* means smooth, and refers to the pods, which in the genus are usually rough.

Description.—A leguminous perennial herb with cylindrical roots running to a considerable length and depth, brown on the outside, yellow inside, soft and succulent. Stems erect, attaining 2 or 3 feet in height, smooth, and of a dull grey colour. Leaves unequally pinnate, leaflets generally about 13. Flowers pale-blue, in erect stalked racemes in the axils formed by the leaves and stems. Pods small, smooth, and compressed. (*Vide* Plate.) Native of North Africa, Southern Europe, Syria, Persia, and Afghanistan, but cultivated in many countries.

Cultivation.—The plant has been tried this side of the Main Range, but the cultivation has not so far proved a success. The part of the colony to suit it should be about Warwick, and thence to the border. Liquorice succeeds best in deep sandy loam, which should be trenched by the spade or plough, or with the aid of both, to a depth of 2 or more feet, and manured if necessary. Plants or sets consist of the side roots which have eyes or buds. These should be dibbled in rows 4 feet apart, and from 18 inches to 2 feet in the rows. The after culture consists of keeping clear of weeds by horse or hand hoeing. August would be the best month for planting. The plant, which requires two or three years to perfect its growth, should yield from 18 to 20 cwt. to the acre.

If practicable, the plants should not be allowed to flower, as the flowering deteriorates, to some extent, the value of the product from a commercial point of view, much of the juice being consumed in perfecting the flowers and fruit, the roots thus becoming impaired.

In England wheat is recommended to follow liquorice, as, in consequence of the highly fertilised and mechanically favourable state of the soil, it has been found to yield heavy crops.

It has been grown in South Australia, and produced very satisfactory crops.

Chemical Composition.—Liquorice root contains, in addition to sugar and albuminous matter, a peculiar sweet substance named *glycyrrhizin*, which is precipitated from solution in water by acids. Being contained in the root as an ammoniacal compound, it forms garnet-coloured shining scales when precipitated, purified, recombined with ammonia, and dried on glass plates. These possess the persistent sweet taste of liquorice; a grain will flavour 6 oz. of water. (P. J. 1875.)

Preparation.—The perennial downward running roots, as well as the long horizontal stolons which they throw off below the surface of the soil, are equally preserved for use. After being dug up, which is done by a process of retrenching the ground, the roots are washed, trimmed, and sorted, and then either sold fresh in their entire state or cut into short lengths and dried for sale.

The extract is prepared by macerating for twenty-four hours 1 lb. of liquorice root sliced, in a gallon of boiling water; then boiling down to four pints, straining the solution, and evaporating it to a requisite consistence.

Extract of liquorice is made up in two forms—viz., in cylindrical rolls or sticks, which is termed *stick liquorice*, and in masses or blocks, which is called *liquorice paste*. The former is the kind used as a sweetmeat and in medicine; the latter principally employed in the preparation of tobacco for chewing and smoking. (B. and T. Med. Pl.)

Market Price.—The wholesale price in Brisbane for small quantities of the dried root ranges from 1s. 3d. to 1s. 9d. per lb.

Construction of the Langstroth Hive.

By H. STEPHENS.

The usual number of frames in a beehive in this colony is ten, but some beekeepers use an eight-frame hive, which has exactly the same sized frames. The dimensions of the hive by outside measurement are $20\frac{1}{4}$ inches long by 16 inches wide and $9\frac{1}{2}$ inches deep, and it is made of fairly dry pine 1 inch or $\frac{7}{8}$-inch thick. Factory hives are usually $\frac{7}{8}$-inch thick, but an exact thickness does not much matter, and clean 1-inch pine planed on one side, so that it may be painted easily, is all that is required, and will look good enough for anything; for to make beekeeping pay we do not want an expensive hive, but one that is easily made and is simple, neat, and strong, for bees will store as much honey in a nail-keg as in the most expensive hive.

I will give here the most economical size of timber to purchase for making hives, and also the sizes to which to cut it to make the various parts of the beehive.

Timber for Hive.—Body of hive requires one piece of pine 6 feet long, 12 inches by 1 inch. Cover requires one piece $21\frac{1}{2}$ inches by $16\frac{1}{2}$ inches by 1 inch. The bottom board is the same size as the cover. The cleats for the cover and bottom board will come off the piece for body of hive, and are $16\frac{1}{4}$ inches long by 2 inches by 1 inch.

How to Make the Hive.—We will start making the body of the hive first, and will take the piece of wood measuring 6 feet by 12 inches by 1 inch, and plane over one side of it—the heart side for preference, as the hive is stronger made in that way; after it is planed, and on both edges, mark a line on the board $9\frac{5}{8}$ inches from the edge and rip it down with the saw; then plane the edges and you will have two boards—one $9\frac{1}{2}$ inches wide, and the other about 2 inches. Mark off the widest piece into four lengths, two of which are 16 inches long and the others $19\frac{1}{4}$ inches. Take the two 16-inch pieces and make a rebate in one edge of each, $\frac{1}{2}$-inch deep and the same wide, and halve the corners so that the side pieces will go halfway through and make the box much stronger. A dovetail or lock-joint corner is strongest, but difficult to make by hand, and a hive with a halved corner will last as long as the wood, if properly put together. Then nail together with $2\frac{1}{2}$-inch nails, but before it is finished.

Hand-holes should be cut in the sides and ends to lift the hive by, and these are made in the centre of the box and about $2\frac{1}{2}$ inches from the top edge, and are cut with a chisel $\frac{3}{4}$-inch wide, and when finished should be about 4 inches long and halfway through the board, and also slightly undercut on the top edge to give a better grip to the hands.

Cover and Bottom Board are only required to be planed on one side and the edges, but the bottom board need only be planed for about 3 inches from one end where the entrance is. The sizes of cover and bottom are exactly the same, and are $21\frac{1}{2}$ inches by $16\frac{1}{2}$ inches by 1 inch.

Cleats for cover and bottom board come off the piece for the body of hive, and have a groove cut in them $\frac{7}{8}$-inch wide and about $\frac{5}{16}$-inch deep; they are improved in appearance by having a $\frac{5}{16}$ bead planed on the edges. The cleats for the bottom board are slightly different from those of the cover, the front one having a rebate 1 inch deep, so that, when nailed on, the top edge comes flush with the board; and the back one has the groove $\frac{3}{8}$-inch from edge, so that, when the two strips $\frac{7}{8}$-inch by $\frac{3}{8}$-inch are nailed on, the body of the hive is raised that much from the bottom board and thus forms the entrance.

Entrance Blocks.—It is often convenient to be able to contract the entrance to the hive in cold weather, or if the colony is weak, and for this purpose triangular blocks are as good as anything. They are made out of pine, $2\frac{3}{8}$ inches wide and $\frac{5}{8}$-inch thick, and of any length according to the

number of blocks required. They should be cut into pieces, of which two sides are $3\frac{1}{4}$ inches long and the other $4\frac{3}{4}$ inches. Three of these blocks will close the entrance to the hive when required—say for keeping the bees in while you cut the grass in front; but in hot weather the entrance is left the full width of the hive.

Frames.—Each hive contains ten frames in which the combs are built, and which are spaced equally across the hive, so that when in their proper places they are $1\frac{3}{8}$ inches from centre to centre of the frame.

There are two kinds of frames used, called loose and fixed frames. The loose frames require to be spaced with the hand, but the fixed sort have a projection on them to make them self-spacing.

The size of the frame is as follows:—

Top bar ...	...	19 inches by $\frac{7}{8}$-inch by $\frac{3}{8}$-inch
Bottom bar	...	$16\frac{3}{4}$ inches by $\frac{7}{8}$-inch by $\frac{3}{8}$-inch
End bar	...	$8\frac{3}{4}$ inches by $\frac{7}{8}$-inch by $\frac{3}{8}$-inch.

To make a set of ten frames requires 45 feet of $\frac{7}{8}$-inch by $\frac{3}{8}$-inch pine.

BEES SWARMING.

Swarming is a natural impulse with bees. With the spring comes the desire to change quarters, and increase the species. First, queen cells are built, and when the queen discovers them she calls her loyal offspring around her, and prepares to leave the hive she has inhabited during the past twelve months. The time chosen to leave the hive is when the queen cells are capped over, say about the ninth day. If carefully watched, the day the swarm will issue may be pretty accurately gauged. The night before the swarm issues, the queen emits a peculiar cry or sound, something like the "peet" of an unhatched chick in its shell. If this be listened for, and heard, it may be safely taken for granted that the swarm will leave the old hive the next morning. The queen does not leave the hive first; she waits until the bees are fairly out and in the air, and then her majesty follows. She has unloaded her ovaries previously; but, unaccustomed to using her wings, she cannot fly very far, and, as a rule, settles within easy reach of the hive. Should the swarm appear to be long in settling, the surest way of making them alight is to sprinkle water over them from a bucket and with a syringe. Should a syringe not be obtainable, the hand may be used. Even after they have settled, it will do no harm to sprinkle the swarm with water before shaking them into their new hive. Bees are not given to stinging when swarming, so long as they are gently handled. They should not be jarred or shaken, except at the last moment, when it is desired to dislodge them from the branch upon which they have settled. It is better to have hives waiting for the swarms than swarms waiting for the hives. A comb of eggs and brood should be placed in the new hive, when the bees will immediately commence work, but otherwise the smallest strip of foundation starter should be given the bees. This is the time when bees make wax, and not honey, and they should be made to draw out new combs in their fresh home. The usual practice is to place the new hive, well propped up, over a sheet, and to shake the swarm in front of it. A little smoke will soon drive them into the hive, when they may be left until nightfall, and then moved to their permanent position. Should it be desired to check swarming, Mr. Bolton advises simply turning the body upside down, when the queen cells are formed. It is claimed that this effectually destroys all embryo queens. With the Heddon hive this is easily done, but with the Langstroth hive the frames should be wedged previously.

The ownership of swarms leaving an apiary is a much-vexed question. So long as the swarm is followed from the time it leaves the hive, the bees may be claimed by the apiarist, but it is doubtful whether they can be claimed once sight of them has been lost. The owner of the land upon which a swarm settles has the first claim to them under other circumstances, but the law is not explicit even upon this point.—"The Drone," in the *Australasian.*

The Rubber Industry.

In this issue of the *Journal*, Mr. E. Cowley concludes his interesting articles on India-rubber. We have given considerable space to this subject, as it is attracting great attention in many parts of the world in consequence of the enormous demand for the article in various industrial processes. Companies have been floated with large capital to produce India-rubber in quantities in Mexico, Central and South America, West Africa, &c., and lately we hear that rubber-trees (it is not stated of what description) have been found in the Solomon Islands. A gentleman arrived last month in Brisbane who was prepared to invest £10,000 in forming a plantation, if he was sure of being able to obtain the necessary constant supply of labour. In view of these facts, it seemed to us that too much light could not be thrown on the subject, and we append to Mr. Cowley's article an adverse view of the prospects of rubber-growing by Dr. D. Morris, C.M.G., Assistant Director of the Royal Gardens, Kew.

INDIA-RUBBER (CAOUTCHOUC).

By E. COWLEY,
Manager, Kamerunga State Nursery, Cairns.

(*Conclusion.*)

Mr. Waldegrave J. Thompson, in a letter to the Cairns *Argus*, 17th August, says, in reference to the rubber-trees planted at Mourilyan Harbour by himself:—"It is now, as near as I can remember, some twelve years ago that I imported a few pounds of Ceara rubber from Ceylon, and planted up about five acres on the north side of the house. The trees grew and throve rapidly, showing that both the soil and climate were suitable. . . . . When I last saw the trees they were about 25 feet high, and, as near as I can remember, about five years of age."*

Perhaps it would be advisable to remark, for the use of would-be planters, that 1 lb. of *Manihot Glaziovii* seed contains 832 seeds. Planted at a distance of 12 feet apart, it would require, to plant an acre, 302 plants, so that 1 lb. of seed would give an abundance of plants for two acres, and allow a good margin for faulty germination.

Up to the present, no further information regarding the rubber trees and industry of British New Guinea has been obtainable; but should this come to hand, it will be published later. The Colonial Botanist's description of *Ficus rigo* (Rubber-bearing Fig of the Rigo district, New Guinea—Ed.) appeared in the September number of this *Journal*. In further reference to *Ficus elastica*, it may be interesting to your readers to quote from the *Kew Bulletin* of September and October, 1896, for which I am indebted to Mr. J. Medley Wood, A.L.S., Curator of Natal Botanic Gardens, who quotes the article in the *Natal Farmer's Magazine*:—

The Assam Rubber plant (*Ficus elastica*, Roxb.), is a large evergreen tree, found in damp forests, from the base of the Sikkim Himalaya eastward

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* The latest report on the Mourilyan Plantation, the correctness of which has been verified on personal inspection by Mr. P. McLean, Under Secretary for Agriculture, shows the estate to be in a deplorable condition. Most of the plantation has reverted to its original virgin state, indeed much of the cleared land appears as if it had never been under cultivation, except for occasional contact with dead or dying rubber-trees which have struggled in vain to outgrow the indigenous flora. On the cleared parts of the estate no more than half-a-dozen trees are in good condition—that is, of those originally planted by the proprietors. But hundreds of healthy-looking young rubber-trees are growing indiscriminately in close proximity to the older trees. These have evidently been self-sown. As to the condition of the trees for giving a supply of cuttings, from 2,500 to 3,000 good healthy cuttings can be obtained from the latter, whilst the older trees would give a fair amount of cuttings without doing them any injury. The cause of the abandonment of the plantation was destruction by a cyclone. The trees were planted in a most exposed situation on a rocky hillside—Ed. *Q.A.J.*

to Assam and Aracan. The Government of India issued directions in May, 1884, that for five years from that date the Assam plantations should be increased by 200 acres a year. The Government also desired that, in order to test the financial results of the cultivation of this rubber, fifty mature trees should be experimentally topped annually. In the reports of subsequent years, the results of these experiments are fully given. The amount of rubber obtained showed singular irregularity year by year. It varied so greatly that, while the yield in one year was as much as 26 lb. per tree, it would fall in another year to a little over 2 lb. The value in money depended, of course, on the market, but, at an average price of 1s. 6d. per lb., the extreme yield per tree varied from 39s. to 36s. The fluctuations of yield of one and the same tree in different years are, therefore, very considerable, and they remain, up to the present, inexplicable, since the officers, under whose personal supervision these experiments were made, have not been able to find out any reasons for, or causes of, these very material fluctuations. There is another point of practical importance. It is well known that *Ficus elastica* will grow with undiminished rapidity and luxuriance in situations remote from the hills, but in such localities it fails to yield caoutchouc. Hence, Mr. Mann concludes, that no greater mistake could be made than to start plantations of this tree in the plains of Bengal. This is true, also, of many parts of the world where the tree has been introduced. In spite of the abundance of the tree under cultivation in the tropics of both the Old and New World, it has nowhere proved valuable for the production of rubber, except in the mountainous parts of Assam. The Conservator of Forests says: "It requires an exceedingly damp atmosphere to do well, and therefore thrives best at the foot of the mountains."

As compared with the market values of India-rubber for November, 1895, quoted in Part II. of these articles, we have the following, obtained from the same source, for July, 1897:—

	s.	d.		s.	d.
Para, fine	3	5	to	3	8
Negro Head	2	0	,,	2	4
Columbian, good to fine	1	10	,,	2	7
Niggers	1	3	,,	1	9
Mozambique, good to fine...	0	10	,,	2	6
Assam and Rangoon	0	9	,,	2	2
Borneo	1	0	,,	1	9
Penang, Java, &c.	1	6	,,	2	2
Madagascar, good to fine	1	0	,,	2	4

Showing that prices have hardened, but not in such an extravagant manner as sometimes quoted. To obtain caoutchouc advantageously from plantations, has so far proved a failure. The many experimenters in other countries have found their followers here (German East Africa). In Togo, the Dalmeida Brothers last year planted 1,500 Ceara rubber-trees for shading their coffee plants. The Kempe Plantation Company contemplate making a caoutchouc plantation in the vicinity of Togo. Experiments with these plants as shade trees in Cameroon (Victoria) had to be abandoned, as they were damaging the coffee-trees. The Para caoutchouc-tree is now being experimented with. In German East Africa, Perrot planted on the Mkulumunzi Plantation, owned by the West German Trading and Plantation Company, 10,000 Ceara caoutchouc-trees, and the St. Paul Plantation owners have put out 30,000 caoutchouc-plants. From other sources the exports of India-rubber from German East Africa are found to have been for 1894 as follow:—

To	Lb.	Rupees.
Germany	156,115 ...	181,905
Great Britain	17,600 ...	25,766
Zanzibar	339,665 ...	475,589

(*India-rubber World*, 10th March.)

Nothing seems more certain than that the great industry will be partly paralysed through exhaustion of present sources of supply, and that the fortunate owners of rubber plantations, be they few or many, will reap huge fortunes. It is this certainty, proved by rubber statistics, which is at the bottom of the great efforts now being made to obtain plantations in Mexico and elsewhere, but chiefly in the former country. Mexico is the home of *Castilloa elastica*, acknowledged to be the best of the rubber-bearing trees from the planter's point of view. *Hevea braziliensis* gives the most valuable rubber—Para—now worth 3s. 7d. per lb., while that from *Castilloa* realises only 2s. 4d. per lb., but the difference in value is greatly owing to the better methods of preparation which obtain in Brazil. When the *Castilloa* milk has been taken in hand by a skilful British chemist, as it shortly will be, we shall, without doubt, see a marked improvement, and the price will be levelled up to within measurable distance of that of "Para, fine."

The prospects of the rubber planters in Mexico, even at present values, are more rosy than those of any other agricultural industry, and this applies more or less to every country in which *Castilloa elastica* will thrive. A profit of 300 per cent. in the eighth year is what experts are promising, and the figures are based in one instance on a selling price of 1s. per lb. and in another of 2s.; the first being less than half the price of *Castilloa* rubber in London to-day, and the second 4d. below it. That rubber can be grown cheaper than it can be purchased from the native collectors, is an absolute fact; and it is obvious that the quality must be far superior to any wild product, except, perhaps, Para, the method of preparing which does not seem capable of improvement. For joint-stock enterprises the cultivation of rubber-trees in Mexico offers a fine field, as there is no substitute for rubber worthy of the name, and small probability of there ever being one. At present adulteration is rife, greatly to the detriment of the trade. We hear of powdered flint and cement being used to eke out the supply, and the demand for old worn-out rubber goods is very great. The only apparent remedy for this disastrous state of things is cultivation on an enormous scale.

(*The Colonies and India*, 20th March.)

The whole tropical world seems to be in a ferment regarding rubber production, and a portion of the excitement has reached Queensland. It were well to calmly consider our position in this connection. It is fairly certain that conditions favourable to the growth of any of the first-class caoutchouc yielding trees do not obtain in our country, however distasteful this fact may be to any of us. As has already been noted, only a very tiny point of Cape York comes within the rubber-producing zone. The editor of *Colonies and India* is speaking to persons residing within that zone, and speaks hopefully, not to say somewhat extravagantly, of the prospects for persons who are, or would be, rubber planters. In India, not only have the residents of the belt within the 10th degree of latitude, north and south of the equator, the necessary temperature and other climatic influences, but, as a rule, have the necessary cheap labour also. The article is certainly not particularly bulky; the collection of the juice does not require scientific ability. The other absolutely necessary conditions being present, it seems a subject warranted to command the attention of those who reside in countries favoured by excessive heat, moisture, and with a native population of a class who are satisfied with and want but little.

Notwithstanding the foregoing, *Manihot Glaziovii* and *Ficus elastica* may well be recommended to those who can utilise the latter for coffee breakwinds, and the former on waste sheltered lands. *Ficus elastica* might be planted on some off the most fertile islands of the coast, and a grove of *Manihot Glaziovii* at one of the State farms or nurseries. The experiments, if successful, would be of infinite future value to one and all.

Under the heading "Echoes of Science," the *Tropical Agriculturist* has the following:—The exploitation of the "Kickxia Africana," a rubber-bearing tree, promises to be important for the West African colonies. At Lagos, the milky juice evaporated gives a superior quality of rubber. All the colonies of the Gulf of Guinea possess this tree.

The report of Mr. H. N. Thompson, assistant conservator of forests, on the Hukong Valley and Upper Nankong Basin, states:—

Every tree in the basin of the Loglai and Taron is known, and their positions are pointed out from father to son. It may be taken as correct that the rubber collected in the forests north of the Gedu goes to Assam. All the rubber that goes to Assam is carried by Naja coolies, who can always be had after the crops are gathered.

The number of rubber-cutters who leave their villages for the Turong (*sic*) forests is known. The rubber, when first collected, is fairly pure, but the Najas have learnt from the native Bennias the trick of adulterating it with earth and stones, and so Assam rubber is not looked on with favour by the Calcutta brokers. It may be added that the same applies to the rubber which finds its way into the Rangoon market, the Chinamen being adepts in skilfully concealing in the rubber earth and stones, principally the latter.

(*Rangoon Gazette.*)

In British North Borneo it is said India-rubber trees have been largely exterminated in many of the districts where they were abundant. The following is extracted from the *Sketch*, and appears in the *Tropical Agriculturist* for June, under the heading "Planting in Sumatra":—

The cycle trade is making us very cosmopolitan in our tastes, for we must have rubber to keep the great Dunlop Company earning dividends (as long as may be) on its famous five millions of capital, and the world's supply of this very useful gum is certainly not on the increase. On the east coast of Sumatra, the rubber-tree flourishes, and there can be no doubt that before long an enormous trade will be developed. The natives tap the wild trees, and have been in the habit of exporting quantities of rubber gathered in this wasteful and unskilful manner, but of late years systematic planting and cultivation of the trees have been practised, and in the Tanjong Kassan district already many fine estates have been formed. Some idea of the profitable nature of the trade may be obtained, when we say that 100,000 trees produce at a low estimate an annual revenue, after deducting expenses, of from £25,000 to £30,000.*

There certainly ought to be some wealthy individuals in the East Indies It is statements like these that may possibly excite the imagination of some. Queenslanders, but it is doubtful if any great fortunes are at present made from the soil agriculturally, except under conditions where the cost of labour is merely nominal.

The following extract from the *Tropical Agriculturist*, 1st July, on Mexican India-rubber, will conclude this series of articles:—The popularity of the cycle and the introduction of electric motor cars have caused such a "run" upon India-rubber that those engaged in the manufacture of tyres have begun to realise the great risk there is of supplies becoming exhausted. The formation of the India-rubber (Mexico) Company, Limited, will therefore be hailed with satisfaction by the "trade," and we should fancy that the promoters will have no difficulty in disposing of all the available shares. The company has been formed to acquire plantations in Mexico, known as "La Esmeralda" and "Llano de Juarez," of over 440 square miles of freehold land, with 350,000 India-rubber trees already available for tapping. The estates also carry a great deal of valuable timber, and certain portions of them appear to be

* The *Ceylon Tropical Agriculturist* gives the profit in Nicaragua, which may arise at the end of the eighth year (on 100,000 trees) at £44,337 10s., and of the ninth year at £47,620, on an original net capital outlay of £3,625. The Government premium is 3d. per tree.—Ed. *Q.A.J.*

adaptable to the purpose of growing cacao-trees and coffee-plants. There are also large plantations of thick gum-trees, which produce the chewing gum so popular in America. The share capital is £406,000, divided into 400,000 ordinary shares of £1, and 6,000 deferred shares of £1 each. The latter will not be entitled to participate in the profits of any year until 15 per cent. for that year has been paid on the ordinary shares, when they will be entitled to one-half of the remaining profits distributed as dividends. There is also an issue of £200,000 7 per cent. first-mortgage debentures of £50 each, redeemable after five years by annual drawings at £60 each, at the option of the directors. A working capital of £50,000 is provided for, and the vendors take £556,000 for the properties, payable as to £150,000 in cash, and as to the balance in cash or shares, or partly in both, at the direction of the directors.

Turning to the details given in the prospectus we find it stated:—The consumption of India-rubber by six countries now exceeds 100,000,000 lb. per annum, worth about £10,000,000, and during the last few years the demand for it has increased enormously and is still increasing, whilst hitherto practically no steps have been taken to meet this growing demand, or to provide for the world's future requirements. Up to the present time, nearly all India-rubber has been obtained from wild trees, but it is admitted, by those most competent to give an opinion, that such a source is barely adequate to meet the present demand, and that the supply of the future will have to come largely from trees properly planted and cultivated. This view is corroborated by the following extract from a recent report to the Foreign Office:—"Judicious tapping," with due regard to the life of the tree and its future usefulness, is the exception; rubber-bearing trees are ruthlessly sacrificed by irresponsible seekers after wealth, and dead trunks are becoming a too familiar feature in the landscape of the productive districts. Sooner or later, a purely destructive policy of this kind must exhaust the richest country.

Subsidy to Plant Rubber-trees.—A subsidy has been granted to the owners of the "Llano de Juarez" by the Mexican Government, providing for a Treasury payment of three cents for every India-rubber tree planted, which attains a certain growth, up to a limit of 15,000,000 trees—equal to about £3,000 per million trees, the trees to be planted at the rate of 1,050,000 per annum. The first year's yield in 1905, from the million trees to be planted this year, should be £250,000, rising in 1908 to £500,000. The first year's yield in 1906, of the million trees to be planted next year, should be £250,000, rising in 1909 to £500,000, and so on. Under the concession granting the subsidy, the Government has the right of pre-emption at the end of ninety-nine years of the lands planted (with the buildings and utensils) at a valuation less an amount equal to double the amount paid by way of subsidy under the concession. If, from any unforeseen causes, the estimates of revenue contained in the prospectus, and upon which the directors are proceeding, should not be realised in their entirety, there is an ample margin shown in the estimates to provide for every contingency, after payment of handsome and yearly increasing dividends.

Demand.—India-rubber has become absolutely indispensable to the cycle tyre, electrical motor cars, cab, and innumerable other manufacturing industries. It is a matter of common knowledge that the consumption of India-rubber in the manufacture of cycle tyres alone has grown by leaps and bounds. In 1886 there were 68 cycle factories in England—there are now more than ten times that number. In France, America, Germany, Australia, and other countries there has also been a great development of the cycle trade. In 1896 no less than 262 undertakings, dealing with the cycle and motor industries, were registered in London alone, with a total capital of £19,898,464. The increasing demand for India-rubber has caused manufacturers to awaken to the problem of a threatened exhaustion of supplies; it is therefore beyond question that this company will supply a want distinctly felt by all manufacturers using India-rubber, and that it has every reasonable prospect of richly rewarding its shareholders.

Treatment of Rubber.—It is intended that the rubber shall be collected and treated, under the care of a resident rubber expert, on the most approved scientific principles, so as to command the highest market price quoted for the best samples of raw rubber. Such rubber on the market is worth about 3s. 6d. per lb., and its superiority over other rubbers is due to the scientific methods employed in its collection ensuring freedom from dirt and impurities. It is anticipated that by the adoption of similar means in gathering the product of this company's estates it will, instead of realising 1s. 8d. per lb. net., find a ready sale at 2s. 6d. per lb. net. Hitherto there has been but a comparatively small outpay of India-rubber from Mexico, collected in a most primitive fashion; and although, in addition to the company's plantations, wild rubber-trees grow in great numbers upon their lands, no organised efforts have been made to exploit the industry. No comparison, therefore, can be justified between the raw rubber, which this company proposes to put upon the market, and that of any other rubber which has ever come out of Mexico.

DR. MORRIS ON THE ADVERSE SIDE.

Dr. Morris says:—If, in a few years or so, rubber of the value of half-a-million could be raised in two little spots in Africa, I think the people who are advocating planting rubber all over the world should look more closely into the matter. We know that, in Brazil, the Amazon Valley and both sides of the Andes are largely devoted to the rubber industry. In Central America, Mexico, and other parts of the world rubber is likewise being produced as a forest product in large quantities. During the last twenty years the price, according to reliable statistics, has risen only a few pence per lb. Before we start planting rubber in our own colonies, and especially on land which can produce other things more valuable, we should be satisfied that the rubber industry is not likely to follow the cinchona industry, which has caused so much loss to planters in the West Indies, India, and Ceylon. The tree which has been the means of yielding so much rubber in Lagos extends probably right across from Sierra Leone to the mouth of the Niger. The tree is not unlikely to be found in extensive tracts in the interior of West Africa.

To which the *Tropical Agriculturist* replies:—

We cannot help still thinking that, large as is the supply of the raw product from the forests of West Africa and South America, an extending demand will do more than take it all off, and that the cultivated article should meet with a remunerative market. But we are bound to show the argument on the other side, especially when stated by so good an authority as Dr. Morris. We therefore give a recent strong utterance of his on the subject, as well as other extracts referring to activity in Bolivia, Brazil, &c., and we ask our planting readers to give all that is stated, due consideration. There is just one remark we would make on Dr. Morris's mention of cinchona—namely, that there is no risk of any planting community rushing into "rubber" as the Ceylon planters did, twenty years ago, into "cinchona." Rubber is not so readily grown, or at any rate not so soon and easily cropped as cinchona bark—a very material difference which must weigh with intending planters. On the other hand, rubber is a product which, if added to an existing tea or coffee or cacao plantation, gives very little trouble after being planted along roads, boundaries, or in fields by itself, till the cropping time arrives—so that the total expenditure upon it should be very moderate indeed.

Evidently recent words of warning as to abundant supplies of rubber must have told on the British capitalist; for a scheme which opened with a glowing prospectus of a "British India-rubber and Exploration Company, Limited," £200,000 capital, to acquire and develop 500 square miles of rubber-growing country, thirty-five miles north of Cape Coast Castle, has fallen to the ground.

The shares were not subscribed for, and yet the reports of experts pointed to profits of something like 30 to 50 per cent. Here are a few striking paragraphs from the prospectus:—

"According to Her Majesty's Foreign Office reports, the consumption of India-rubber by six countries now exceeds one hundred million pounds (lb.) per annum, worth in the market about ten million pounds sterling (£10,000,000); within the past eighteen months the price of rubber has risen enormously, as it is absolutely indispensable for cycle tyres, motor cars, cabs, and various other industries. It is a well-known fact that the consumption of rubber in the manufacture of cycle tyres alone has reached prodigious proportions; and according to many competent authorities the supply of the raw material does not equal the demand. It is estimated that there are in England over one thousand cycle factories to-day, working at full pressure, and last year there were registered in London alone cycle and motor corporations giving a total capital of £19,898,000. Messrs. Bagot and Anderson estimate that there are at least four hundred and fifty thousand (450,000) trees yielding rubber on the property proposed to be acquired by this company, and the directors contemplate making arrangements to plant a large number of additional trees, thereby providing for a future continuous supply. A very large proportion of the rubber, at present being shipped from West Africa, is taken from the district in which this property is located.

"As it is estimated that there are some 450,000 trees on the property at present bearing rubber, and as an average rubber-tree yields a minimum supply of three pounds of India-rubber annually, from which, at the very low estimate of 2s. per lb. (and marketable rubber is now selling at about 3s. 6d. per lb.), a gross revenue should be earned from India-rubber for the first year of the company's operations of £135,000 (*vide* report of George Bagot). The supply from an India-rubber tree is stated to increase 1 lb. per tree per annum for several years after the first year's tapping. Consequently, from the 450,000 trees the revenue for 1898 should be about £180,000 gross, again assuming that rubber realises only 2s. per lb. on the market in 1898. Marketable rubber is now selling on an average at about 3s. to 3s. 6d. per lb., so that in quoting 2s. per lb. the directors are placing a very low estimate on the sale price. It is the general opinion that the price will still further advance, and the Press quotations given hereafter confirm this belief."

There can be little doubt that West Africa rivals the valley of the Amazon as a home for rubber; but year by year the goose that yields the golden harvest is being used up; and if the demand, as seems likely, goes on increasing, we do not see that planters should be discouraged from putting in rubber, more especially as a by-product where they have plantations already formed of tea, coffee, or cacao, or even coconuts, as their staple.

FACTS ABOUT RUBBER.

The Life of a Rubber-tree.—The New York *World* notices three young rubber-trees transplanted from the forest to a cultivated field in Soconusco, Mexico, which at the time of writing (1892) were 7 feet in diameter, and had yielded rubber for more than thirty-five years, the then product averaging more than 50 lb. of gum per year.

Productiveness.—Mr. Rowland W. Cater, writing of rubber-trees in Nicaragua, says that the average increase in production is generally estimated at 1 lb. of rubber for each year of the tree's life up to a certain age, which he was unable to fix.

Milk Production.—Trees tapped in the wet season yield five times as much milk as in the dry. Sixty per cent. of the milk ought to be turned into rubber. A good coagulating agent is 1 oz. of alum in 16 oz. of water. A weak solution of alcohol will give even better results.

A Day's Work at Gathering.—A huléro (Indian or Carib rubber-gatherer of Nicaragua) can tap four wild creeper-grown trees in a day. In a plantation, where the trees are weeded and cleaned of superfluous growth, he can tap five at least, and also plaster the cuts with mud. A huléro's wages are 1s. 3d. per day. The *Castilloa* grows to a height of 60 feet. It seeds in its tenth year.

Tapping.—It should not be tapped before its eighth year. The cuts made in tapping the tree should be plastered up, when the tree would be ready for tapping again in six months; but the huléro works in the forests, which are No-man's Land, and he says: "Plenty hulé heah, sah! Me fin' ten—twenty mo' tree while um doin' dat. An' what goo'? Perhaps I nevah come back heah no mo'." Hence the trees, once tapped, dry up and die.

Development of the Industry in Africa.—From a paper recently read by Sir Gilbert T. Carter, K.C.M.G., before the Royal Colonial Institute, we learn that the development of the rubber industry in certain parts of the Yoruba country (West Africa) since 1893 has been phenomenal. While in 1893 the total export amounted to 5,867 lb., valued at £324 6s. 4d., the following year it rose to 5,069,576 lb., valued at £269,893, and in 1896 the value reached the large total of £347,730. The tree from which these supplies are drawn is known as the *Kickxia africana.* Large companies are being formed, and people say, "If you plant anything, plant rubber."

Sisal Hemp (Agave rigida).

By THE UNDER SECRETARY FOR AGRICULTURE, QUEENSLAND.

Introduction.

Owing to the good seasons that have recently prevailed, the low price of nearly all agricultural produce, and the fact that nearly all producers devote their whole time and energy to the production of a few crops, such as sugar, maize, potatoes, hay, and vegetables, while our consuming population is limited, there is a general spirit of inquiry at present in operation in our agricultural centres as to whether it is not possible to secure from the soil some crop likely to prove more remunerative than the above—but one for which the market is more general—and, consequently, a wider outlet for the produce when grown.

Not only are our regular producers looking for a better market, but there are quite a number of people settled on the land who took to farming when the area of land open to selection was very limited, and the nature of the soil of which was such that it would require an expenditure for fertilisers far in excess of the value of its produce. These people, then, who have been struggling all these years, keeping a few cows—which run on adjacent Crown lands—and make a few pounds of butter a week, are doubtless anxious to learn if there is any prospect of their ever being able to raise a crop of anything that will give them a chance of getting their heads above water or in anyway bettering their condition.

Within an area of twenty-five miles of Brisbane, and in many other parts of the colony, there is a quantity of poor, sandy soil, that can only be made to yield a fair return after a large expenditure of money for various manures. It is to this class of country we wish specially to call attention, and to point out how a return may be got.

On such land as this, there are two species of plants which may be profitably cultivated—viz., fibre plants and tanning plants. Among the latter the wattle occupies chief place. There are many people, however, who, though willing to enter upon the cultivation of the wattle, are deterred by the knowledge that it takes from four to seven years before any returns can be secured.

Among the fibre plants particular attention has lately been directed to one class—viz., the *Agave rigida* and its varieties—as admirably adapted to poor, sandy country, and from which remunerative returns can be secured. But it is just as well to state right here that it takes about three years to secure a return from this plant.

Those, therefore, who enter upon its cultivation must make other provision for maintenance during the period the *Agave* crop is maturing.

Like many other tropical and sub-tropical products, until recently, it could not remuneratively be cultivated without the aid of cheap labour. But the improvements effected in the machinery for preparing the fibre have been of such a nature as to completely revolutionise the industry.

The new fibre machines recently tried at the Bahamas are capable of cleaning 50,000 leaves of the *Agave rigida*, var. *sisalana* (Sisal Hemp), per day, the product in fibre being 3,000 lb.; the old hand machines being only able to operate on 3,000 leaves producing 180 lb. of fibre.

In Yucatan the population is probably not more than 300,000 souls, and the value of their exports of sisal hemp alone exceeds in round numbers $10,000,000. Mauritius, again, went in for sisal hemp culture in 1882, and her exports in the seasons 1885-86 were 760 tons; in 1886-87, 1,586 tons; in 1887-88, 2,060 tons; and in 1888-89, over 5,000 tons, thus showing that the

exports are doubling every year; and from the present activity with which the inhabitants are going in for the industry the island bids fair to eclipse Yucatan, Mexico, the Bahamas, and other places where sisal is produced. There is an unlimited demand for the article in Europe, and Queensland need not fear over-competition in this.

The plant is easily propagated, thrives in the poorest of soils—in fact, will grow where nothing else will—and yields a finer fibre than if grown on really rich soil. The plant is very hardy, stands any amount of dry weather, requires little or no attention after planting, has no diseases nor enemies; cattle will not even touch it—in fact, are used as the means of keeping the weeds in check. It gives a most valuable and easily manipulated fibre. In the Bahamas, not so very long since, this plant was looked upon in exactly the same light as rabbits are here in Australia—an inevitable, irremediable pest—but now it is fostered and made much of, being considered the only means of salvation of the country. The Bahamas variety of *Agave*, the "Pita," is considered as producing the finest and highest priced fibre, a sample having recently sold in London for £50 15s. per ton.

All authorities concur in the statement that sisal hemp gives a net return of 75 per cent. on the capital invested. The machinery is most simple and inexpensive, the market for the fibre is already established, and the demand is unlimited. The cost of planting and maintaining 120 acres for four years before any return is obtained is reckoned at £913, including interest on an outlay at 10 per cent.; the cost of manufacture, machinery, &c., for the fifth and sixth years amounts to £3,130; total, £4,043. The yield during the fifth and sixth years is calculated at 180 tons of fibre of the value of £9,000; profit in six years, £4,957. This is not considered as at all a too sanguine estimate—in fact, rather unfavourable than otherwise.

Botanical.

Agave, Linn. Gen. Pl. III. 738, is the name of a large and important genus belonging to the natural order Amaryllideæ. There are several species, all originally natives of Central America, and chiefly of Mexico. They are now, however, widely acclimatised in most warm, temperate, or sub-tropical and tropical countries. They are commonly, but erroneously, called "American aloes." From the Aloe proper they are botanically separated by the position of the ovary, which is inferior in the *Agave*, but superior in the aloe.

They take several years to reach the flowering stage, and from the fact that, in adverse circumstances, their development may be retarded from ten to fifty, even to 100 years, they are popularly called the "Century Plants."

Varieties.

Of the sisal hemp plant, *Agave rigida*, there are several varieties, but the three chief ones from which the sisal hemp of commerce is extracted are:—

(1) *Agave rigida*, var. *elongata*, of a grayish-green colour, with thorny spines on the edges of the leaves.

(2) *Agave rigida*, var. *sisalana*, of a dark-green colour, having no spines on the edges of the leaves, the absence of which facilitates handling.

(3) *Agave Heteracantha*, known as "Ixtl" in Mexico, is largely used in the manufacture of nail and scrubbing brushes, for which purpose a very great demand exists for the fibre. It is also used in the manufacture of corsets, and recently in the manufacture of artificial flowers.

In the Mauritius, however, the plant furnishing what is known commercially as Mauritius hemp, is the *Fourcroya gigantea*, or, popularly, the Green Aloe. This plant is erroneously supposed to be an *Agave*. It belongs, however, to the same natural order as the *Agave*—viz., Amaryllideæ.

The *Furcræa*, as it is often written, is found growing in the Bundaberg and Maryborough and Townsville districts, and probably all over the North, considerable diversity of opinion existing among residents of the above districts as to whether it was a true sisal hemp plant or not. The *Fourcroya*, although not so valuable a fibre plant as the *Agave sisalana*, is nevertheless of considerable commercial value, and in districts where the plant is evidently acclimatised it were folly not to utilise it.

Of the seven varieties of *Agave* plant cultivated in Yucatan the best is that known as "Sacqui," meaning "white" in the Indian dialect, owing to the light-green colour of its leaves. This variety possesses all the best attributes of a fibre plant—abundance, flexibility, whiteness, strength, length, and weight. The leaves of all the varieties vary in size from 5 feet to 7½ feet in length by 4 inches to 7 inches in width.

In Yucatan the plant has seemingly many names—for instance, the Spanish name is "Henequin," and the Indian "Sacqui." Doctor Perrino, who introduced it into Florida, gave it the name of *Agave sisalana*; in Cuba it is known as the "maguey"; but M. Jules Lachaume, of the Acclimatisation Gardens, Havana, who in 1876, at the Centennial Exposition, Philadelphia, exhibited fifty-seven specimens of *Agaves*, says it is known to botanists as the *Americana mexicana*. The "Pita" of the Bahamas is not the above plant.

Soil.

The plant thrives best on a rocky, gravelly soil, on which it produces the finest fibre. Any poor, impoverished-looking, high and dry land, or any bare hillside will answer equally as well. The more exposed the better, *shade being prejudicial even in the earliest stages of growth.* The plant will not thrive at all on wet land. On very rich or good agricultural land it will grow luxuriantly, but the fibre will be very inferior in quality. This is one of the conundrums in Nature difficult to solve, but a fact nevertheless. Any hungry-looking soil, in fact, will answer for its profitable cultivation.

Planting.

The *Agave* is easily propagated from seed and suckers. Where suckers are readily procurable they are much to be preferred to seed, the returns being obtained quicker by a year or two. Plants raised from seed do not yield till four to five years old, whereas from suckers or young plants a yield is obtained in the third year. Of course, in the absence of a supply of suckers or young plants seed must be obtained and planted in a nursery, the plants being put out from the nursery when from 18 inches to 24 inches in height. These are so hardy that they will bear transplanting at any age, and may be planted out in any weather; but they are usually put out during wet weather, more as a matter of convenience than for any other reason. In removing young plants from the nursery and before planting them out, the roots are cut off right up to the stem, and any dry leaves pulled off, exactly in the same manner as pineapple slips and suckers. The land requires no preparation whatever prior to planting out; no ploughing, cross-ploughing, or harrowing is needed. The *Agave* should be planted in rows 11 feet apart, and 6 to 7 feet apart in the rows; this will give 650 plants to the acre. The land should be laid out in blocks with roads between. Regularity in laying them out is essential for harvesting. Holes are dug at the distances marked, and the young plants stuck in, care being taken to have them upright and straight in the rows, for if not, and they grow up at angles in all directions, there will be no getting between them to gather the leaves of those ripe first.

Cultivation.

After the plants are once put in, with the exception of a weeding or two during the earlier stages of growth, they require no attention. A writer in 1853 said, "The simplicity of the cultivation may be conceived from the statement that there is not a hoe, nor spade, nor harrow, nor plough employed in

the agriculture of all Zucatan." When the plants are from three to four years old any stock may safely be turned in to keep the weeds down. In their young stage they should be protected from stock, not so much from fear of their being eaten as of being knocked out and about or trampled under. Weeds must never be allowed to grow high enough to shade the plants; otherwise weeds do no injury.

Harvesting.

In the third year at the earliest, the cutting of the lower leaves may be commenced, and the same operation repeated every four months. The leaves when ready for cutting incline downwards to a horizontal position, and the colour gets darker. Care must be taken to cut the leaves from the bottom upwards as they are found to be ready, the cutting being done quite close to the stem. If the *Agave rigida* is being harvested, care must be taken as soon each leaf is cut to trim off the spines on the edges to facilitate handling. The leaves are usually tied in bundles of twenty-five or fifty, point to butt alternately, and carried to the headland, whence they are taken up by drays. One man can cut and tie up on an average 1,200 leaves per day. The knife for cutting the leaves is an ordinary sheath knife with an 8-inch blade.

Life and Yield.

At intervals of two years the plant throws out shoots from the roots, from five to ten in number, which may either be cut and planted out or destroyed. The *Agave* will continue yielding leaves up to fifteen years, when it is cut down, care being taken to leave one of the suckers thrown up previous to this period to take the place of the parent plant when done with. It will be observed from this that when once a given area is put under *Agave* an unlimited supply of plants is available for extending the area, and further the original area never requires replanting, as one sucker is always left.

Each robust plant is capable of yielding from twenty-five up to 100 leaves per annum. Hence one acre containing 600 plants will produce from 15,000 to 60,000 leaves per annum. The average yield of dry fibre from 100 leaves is 4 lb.; therefore 1 acre will yield from 600 lb. to 1 ton of fibre. Frequently 1½ tons per acre have been realised, and when more improved machinery is brought into use from 2 to 2½ tons per acre may be realised. The working expenses have usually averaged about 30 per cent. of the value of fibre per acre. Therefore taking an average yield of 1 ton of fibre at, say, £40, and from this deducting 50 per cent. for working expenses, it will be seen that a net profit of £20 per acre is obtained. The cultivation of the *Agave* and its manufacture provide ample, steady, and well-paid employment for men, women, and children. As showing what profits are realisable from this industry, Mr. D. J. Stoddart, in his pamphlet on the sisal hemp, says:—"Many farmers' daily incomes are from $500 (£100) to $2,000 (£400)."

Extraction of Fibre.

This is best accomplished by machinery, which is very simple and inexpensive, and is worked by youths. There are several in use in Mauritius, which, although not perfect, are doing satisfactory work. The one most favoured in Mauritius is an improvement on the original machine, the paternity of which cannot be fixed, many persons having had a hand in it. It is, however, known as being invented by M. Digard and modified by M. Cazolet. Another machine, known as the "Marabal," was invented by Messrs. Mérandon and Bonieux. In Yucatan and Mexico a number of Death and Ellwood's machines are in use, which are as nearly perfect as possible. The Kennedy machine is also much favoured, and has lately been considerably improved.

The fibre is also, in small areas, extracted by hand, but it is a slow and laborious method. The process consists in squeezing the leaves through heavy rollers—a heavy mangle would do—so as to break the hard bark and squeeze out the juice. The crushed leaves are then pounded on a smooth

stone by a wooden mallet until all the bark and woody matter are removed. The fibre is then washed until the whole of the sap and dirt are cleaned out. It is afterwards thoroughly dried by hanging up in the sun, and lastly baled. Proximity to water is necessary in these operations. One Death and Ellwood's machine is sufficient to operate on the product of 100 acres. The largest part of the expenditure is for motive power. The machines in use in Mauritius appear to fully meet the requirements of the planters there, and, moreover, they have been adopted after careful trial with other machines, which have been ultimately discarded.

The machine generally in use is known by the name of "Gratte." It consists of a drum 2 feet in diameter and 1 foot wide. On the circumference of this are bolted 2-inch L-shaped blades, parallel to the axis. The blades should be of steel. They are firmly fixed to the drum by means of bolts and nuts. The drum is mounted upon an axle, and revolves with great speed, the blades passing close to and against the front or edge of a feed table, "Oervaute." This table is adjusted by means of screws, so as to approach to within a quarter of an inch or further as may be required. The drum weighs about 4 cwt., and the cost, including driving pulley and bolts, would be about £24 in Mauritius. Each machine is capable of treating up to 250 lb. of wet fibre per day, The machine can be worked by steam or water power. If by steam, a 3 h.p. engine is all the motive power required.

A new and more improved machine has lately been patented in America, particulars of which are not to hand yet.

The "Forges and Fonderies de Maurice" are the makers of the machine above described.

Other Uses of the "Agave."

The uses to which the *Agave* is put are not confined to fibre production only, for we find that the juice of the leaves actually yields some 6 per cent. of cane sugar (Boisingault). The juice also is made into an intoxicating beverage, known as "pulque" in Mexico, 50,000,000 bottles being annually introduced into Mexico from the Maguey district. The juice boiled and the watery portion evaporated by artificial heat or sun and mixed with lye-ash makes a soap that lathers equally as well with salt as with fresh water, one gallon of the juice yielding about 1 lb. of the soft extract. It also makes when distilled a brandy known as "Mexical"; also an excellent vinegar. The juice of the leaves mixed with wall plaster is said to make it proof against the ravages of the white ant. The roots furnish a medicine.

At the request of the Acting Agent-General for Queensland, Mr. Charles S. Dicken, a memorandum (here subjoined) was furnished to this Department in December, 1895, by Mr. F. A. Abel, secretary and director of the Imperial Institute, London, on the cultivation of the plant and the extraction and preparation of the fibre:—

MEMORANDUM ON *AGAVE.*

There are several species of the genus *Agave*, most of them originally natives of Central America, and chiefly of Mexico. The *Agave americana*, Century Plant, or American Aloe—called in Mexico the "Maguey," or "tree of wonders"—produces the fibre known as the American Aloe or Pita fibre.

The *Agave vivipara* is a plant very similar to *Agave americana*, but of less robust growth. It is common in the North-west Provinces of India, and produces the fibre known as "Bombay aloe fibre." *Agave rigida*, var. *sisalana*, is the source of the sisal hemp of the Bahamas; *Agave rigida*, var. *elongata*, produces the Henequen or Sacqui fibre of Yucatan. The above species of *Agave* are easily cultivated, and do not require a rich soil. In Yucatan it is found that the fibre-yielding plants thrive best and yield the largest amount of fibre in comparatively arid districts only a few feet above the sea. Moist or rich land is considered unsuitable, for, although the plants will grow in such soil, the quantity of fibre yielded would be comparatively small. A gravelly soil

seems to be best suited for the growth of the aloe plant; a damp or water-logged soil is death to it. No manure is required, as the plant grows on the most stony ground, where apparently there is insufficient soil to support its life.

The *Agaves* thrive under great variations of temperature. While luxuriating on the plains under warm tropical influences, the plant seems equally at home on the hills under widely different climatic conditions. This strikes the Indian traveller forcibly when, after hurrying across the tropical plains of Madras, where the *Agave* is extensively used as a hedge-plant, he finds on the hills, amid a temperate vegetation, equally luxuriant hedgerows of *Agave*.

The following extracts are taken from a report by Captain Jerome Stuart on the fibre industry of Yucatan:—

The soil in the "fibre-producing district" of Yucatan is gravelly and stony, and varies in colour, being black, brown, and red. It has an average depth of 8 inches, and is underlaid by a soft limestone rock. The largest fibre fields in the State are to be found on this shallow stony soil; and the yield of fibre is greater than on the deeper soil thirty miles further inland.

There are several species of *Agave* to be found in Yucatan; but as two only are of chief commercial value, the report is confined to these.

The kind of fibre plant growing in Yucatan, and known as the Sacqui or Henequen, is a different and distinct *Agave* from that of the Bahamas hemp. The plant is hardy, and has, when cultivated, an average life of eighteen years; and propagates itself by sending out suckers from its roots. The Henequen requires from five to eight years' growth to produce a marketable length (3 feet) of fibre. The leaf from which the fibre is extracted has a thorn at the point, and spines on its edges, and averages 3¼ feet in length.

The Bahamas hemp (*Agave rigida*, var. *sisalana*) differs from the Henequen, inasmuch as the leaves are without spines on their edges; and the fibre is superior in texture. The plant matures from two to three years earlier than the Henequen, and has an average life of twelve years. Like the Henequen, it propagates itself from suckers, but is also capable of producing over 2,000 plants from the pole that grows from the centre of the plant.

The Henequen and Bahamas hemp are the hardiest of all the *Agaves*. Their power to withstand drought is almost incredible. Plants of the Bahama hemp have been known to lie on the ground for three months, exposed to the rays of the sun, and when planted to grow with the greatest vigour. These plants have never been known to be troubled with any organic disease. No fungus or insect can apparently damage or affect them; and in 1883, when the locust devastated the State of Yucatan, the cattle and birds died of starvation, and men were on the eve of despair, the only green living plants to be seen were the different species of *Agaves*, and they are now looked upon as the salvation of the State. Although not apparently subject to disease, and capable of resisting a drought eleven months in twelve, the plant is not altogether free from the effects of sudden changes of heat and cold, and is liable to be damaged by floods of rain immediately after a long drought if accompanied by a sudden fall of temperature. This happened in Yucatan in 1888, when, after a severe drought, the rains came on suddenly, with hail and a heavy wind from the north-west, with a fall of temperature from 89 degrees to 57 degrees, and within one night about 90 per cent. of the plants were damaged or blasted on the ends of the leaves, about an average of three leaves to the plant being affected, causing a loss of 3 to 5 per cent. of leaf.

There are several kinds of machinery used for extracting the fibre on the different estates. Those cleaning less than 75,000 leaves per day use the large common machines, "Raspador" and "Barraclough"; and those cleaning from 80,000 to 120,000 per day use the larger and more complicated machines —the Prieto, Villamore, Weicher, Death and Ellwood, &c. The planters, if using one of the large machines, keep several of the Raspadors in reserve, for

use in case of accidents; for should the large machine break down or get out of order, leaving 70,000 or 80,000 leaves on hand, and there be no means of cleaning them, it would involve a loss of over 4,000 lb. of fibre.

The Raspador is a 54-inch "wheel," said to be invented and manufactured in Mexico. It requires a 2-horse power engine to run it at a steady rate of 200 revolutions per minute, at which speed the best results are obtained. Capacity, 500 lb. dry fibre per day of ten hours; requires the services of two men.

The Barraclough, constructed by T. Barraclough and Co., Manchester, is similar to the Raspador, but of superior make. Capacity, 500 to 600 lb. dry fibre daily.

The Prieto machine is manufactured by Ping and Negre, Barcelona, Spain; requires a 16-horse power engine and the services of two men and a boy. Capacity, 7,000 lb. dry fibre per day of ten hours. Cost, 4,500 dollars.

The Villamore machine, made by Krajewski and Pesant, 35 Broadway, New York, requires a 15-horse power engine and the services of two men and a boy. Capacity, 6,000 lb. fibre per day of ten hours. Frame made of wood. Cost, 500 dollars.

The Weicher machine, constructed by J. J. Weicher, 108 Liberty street, New York, is fitted with a service-pipe for throwing a stream of water on the fibre as it is being cleaned, and is claimed by the inventor to lose but 1½ per cent. only, as the leaves are fed into the machine endwise. Requires 12-horse power engine and services of three men. Capacity, 2,500 lb. dry fibre per day of ten hours.

The Death and Ellwood machine, constructed by W. E. Death, of Brixton (London S.E.), requires a 3-horse power engine to drive it at a velocity of 400 revolutions per minute, and washes the fibre when cleaning. Like the "Weicher," the leaves are fed into the machine endwise.

With the exception of the Raspador and Barraclough, all the other machines are automatic; they rasp the pulp from the fibre on the same principle as the Raspador. Their wheels being smaller, require a velocity of 500 revolutions to the minute to give good results. Beyond cleaning a greater number of leaves, they do not appear to do better work, as the percentage of loss is as great in the one as the other, and the fibre is equally as clean.

There are 200 Henequen estates in Yucatan, varying from 500 to 28,000 acres in extent, having a total of 105,000 acres under cultivation, employing 12,000 Indian labourers. The largest and best estates are on the rocky gravelly lands. Each estate is managed by three principal men—the attorney, the manager, and assistant manager. The largest of them employ locomotives for hauling in the crop from the fields, others using tramway trucks or carts drawn by mules or oxen. Estates with less than 800 acres under cultivation erect one "Raspador" for every 100 acres. Those of 1,000 acres use the large automatic machines.

The size of the cultivations on the estates ranges from 250 to 3,500 acres. They are laid out in fields or sections of 50 to 200 acres, and contain from 600 to 900 plants to the acre. When preparing the fields the land is cut during the dry season, is then allowed to spring up, after which it is "sprig-weeded," and burnt after the first fall of rain. The stumps are cut close to the ground so as to be out of the way of the leaves of the plants, and to facilitate the running of the line for planting and getting the rows straight.

The plants are "set out" on the different estates at various distances, being—6 feet by 11 feet, 5 feet by 11 feet, 4 feet by 11 feet, 6 feet by 10 feet, 5 feet by 10 feet, 4 feet by 10 feet, 6 feet by 9 feet, 5 feet by 9 feet, 4 feet by 9 feet, 6 feet by 8 feet. The rows are kept perfectly straight, for if they be otherwise there would be the greatest difficulty in getting through the fields. When planting, the labourers have a small line with the distances at which the plants are to be "set out" knotted on it, and a pole cut to the length that the rows are to be apart. A man and boy are employed at each line. The boy

drops the plants along the row at the distance marked on the line, and then removes the line to the next row, dropping the plants as before. The man does the planting, and is responsible for the rows being straight. When coming to a rock the planter does not turn aside, but goes on and places the plant in the row a little beyond. The row system facilitates weeding, admits a free current of air and sunlight, which is necessary to harden and give strength and texture to the fibre; allows the labourer to cut and bring out the leaf with despatch, and, what is of the greatest importance, gives room for replanting the field when the life of the old plants is about to terminate, which cannot be done if the plants are growing over the field irregularly. Plants of less than 15 inches are not planted. In Yucatan, the Herequen matures in five to eight years. In the Bahamas, the Bahama hemp matures in three to five years. To neglect cutting the leaves after the plant is matured retards its growth, which causes it to "pole," at the appearance of which the life of the plant is ended; and the planter, after reaping a few leaves only, must then plant his fields afresh. On the other hand, when the cutting is regularly attended to, the life of the plant is prolonged, and the plant will produce a greater number of leaves and fibre of a greater length and superior quality. The plant is cut every three months, when seven to nine leaves are gathered. The leaf is taken from the plant with a "clean cut," the gatherer making the cut down and inward at an angle of 45 degrees.

As soon as the leaves are cut, they are taken to the machine for cleaning. The cleaning is so arranged that one-half of the leaves to be cleaned are taken from the cuttings of the day previous, and the other half from the cuttings of the same day, as in this manner the work can be commenced early in the morning, and steadily carried on without waiting for leaves to be brought in from the field. The leaves are not allowed to accumulate beyond half-a-day's cleaning, for if left to dry beyond the second day they become hard, and the fibre when extracted will be dark. When the Raspador is used for extracting the fibre, two operators are required; one stands to the left of the wheel, and the other to the right. The operator on the left taking a leaf fastens the small end with a lever to prevent the whole of it being drawn into the machine; the larger end is inserted and cleaned; the other operator then hauls out and reverses the leaf, putting in the uncleaned end, at the same time taking a turn with the cleaned end of the leaf around a brass cleat which is fitted to the machine for the purpose, and managing a brake that regulates the pressure required for cleaning the leaf, finally drawing out the clean fibre. In this manner fourteen leaves per minute, or 8,400 leaves, are cleaned for a day's work.

When cleaning with the Villamore, Prieto, or other automatic machines, all that is necessary is to lay the bundles of leaves on a platform fitted for the purpose, when an endless chain draws them into the machine, the mechanism of which is so arranged that one wheel cleans one half of the leaf, the chain taking it along where another wheel cleans the other half, and then throws out the clean fibre at the opposite end. Two men and a boy are employed at the machine—one man to see that the leaves enter the machine on their length, and that they do not ride one on the other; one to attend to and regulate the machine; and the boy to receive the fibre as it is brought out by the endless chain. As soon as the fibre is extracted it is dried, for if allowed to remain without being exposed to the sun immediately after cleaning it becomes dark and spotted.

The yield of fibre from an acre of Henequen is from 1,000 to 1,470 lb. per annum. The number of plants usually set out in an acre is 650, giving an average of 33 leaves from each plant, and from 50 to 70 lb. of clean fibre to the 1,000 leaves. Making an average calculation of 650 plants to the acre, 33 leaves from each plant, yielding 60 lb. of fibre to the 1,000 leaves, the return would be as follows:—$33 \times 650 = 21{,}450$ leaves yielding $60 \times 21\frac{450}{1000} =$ 1,287 lb. clean fibre per annum.

Further information may be obtained from Spons' Encyclopædia of Manufactures under "Fibrous Substances"—*Agave americana*, *A. vivipara*, *A. sisalana;* from Watt's "Dictionary of the Economic Products of India," vol. i., pp. 133-144; from Christy's "New Commercial Plants," and from the *Kew Bulletin* for March, 1887.

Hints have also been given to intending growers of *Agave* fibre in a paper read at the Imperial Institute on Thursday, 29th November, by Mr. A. Vandendriesche, of which an abstract has been published in the *Imperial Institute Journal* for 1895, No. 2, page 59.

PLANTS FOR DISTRIBUTION.

The Department of Agriculture have a limited quantity of plants of the *Agave rigida* (Sisal Hemp) for distribution. Those desirous of entering upon its cultivation should make application to the Under Secretary for Agriculture.

Ramie (Boehmeria nivea).

THE CHINA-GRASS.

COLLATED BY A. J. BOYD,
Queensland Agricultural Department.

It would appear from reports lately received that there is some probability of a machine being introduced to the colony which will effect the long-sought-for process of extracting the valuable fibre from the ramie plant, leaving it in a satisfactory state—*i.e.*, clean, strong, and economically. Should this difficulty have been overcome, then we may look for a considerable extension of the industry, and its introduction for commercial purposes into this colony. It is well known that the plant will thrive in Queensland, and at the Kamerunga Nursery at Cairns it is cultivated with a view to future distribution as soon as the cleansing problem has been solved beyond doubt. It may also be seen at the Acclimatisation Gardens and Botanic Gardens in Brisbane. There are two kinds of ramie. One is the variety named above. It is a shrub which grows to a height of 8 feet in suitable localities. It belongs to the order of nettles (*Urticaceæ*). The leaves are ovate, and notched round the edge on fairly long leaf-stalks, green above but white beneath. The flowers are very small, and borne on long hanging racemes from the axils of the leaves. They resemble those of an English nettle, and are greenish-white. The stems of the plants are woody, about as thick as a pencil, and when full-grown are reddish-brown in colour.

The variety *Tenacissima* is commonly known as Rhea-grass. It is distinguished by its leaves being greener, sometimes quite green on the backs; and though there are forms of it in which the backs are whitish, they have not the conspicuous white colour of the real China-grass. The home of this variety is not clearly known, but it occurs either wild or as an escape from cultivation in Assam, Burma, Bengal, and Sumatra. It is generally said (we are quoting the *Agricultural Bulletin* of the Malay Peninsula, June, 1897) that the white-leaved ramie grows in temperate or sub-temperate regions, and the green-leaved rhea in hot climates. The former has been grown successfully at Kew out of doors, but the latter has failed. Both kinds are in cultivation in the Botanic Gardens at Singapore, and both grow exceedingly readily; the rhea, however, does seem to grow a little faster. At the same time, as Indian rhea is stated to fetch always a lower price than China-grass, and the latter grows quite rapidly enough for all practical purposes here, it would be most desirable to grow ramie in preference to rhea.

Cultivation.—The plant is always grown from cuttings, unless it is, for any reason, absolutely essential to use seed. Raising from seed is easy enough; though slow; but as the stems are or should be cut before the plant flowers in a plantation, it would be difficult to procure ripe seed. Almost any bit of the stem, if sufficiently woody, will grow, but it is best to make rooted cuttings from the base of the plant. The stems underground push out stolons in all directions, which are, in old clumps, often tuberous, and portions of these speedily emit branches when cut and planted. Cuttings should be shaded at first till they are well established.

Soil and Climate.—Very nearly any soil will do for ramie, except very stiff clay or very wet soil. Flooding quickly kills it. Partial shade suits it well, but it will grow exposed to full sun. It suffers somewhat from drought. A constant change from very hot and dry to heavy rain not only does not suit the plant but spoils the fibre, which grows irregularly unless there are no great variations of climate.

Manure.—The plant is certainly much improved by manuring; wood ash and cowdung seem to suit it best.

Growth.—The rapidity with which the plants produce stems depends mainly on the size of the clumps. Rooted cuttings or tubers throw up shoots much faster than stem-cuttings. The stems themselves grow very rapidly, and attain a height under certain circumstances of 8 feet, but they are best cut when about 4 feet high. When fit to cut, the bark should be brown and the stems quite firm. When over 4 feet tall, the fibre appears to be inferior.

Enemies.—The only enemy seen here is a small moth-caterpillar, which rolls the leaf up and eats it. It does not appear to injure the plant much unless it occurs in great quantities, but it spoils the appearance of the plant, and may weaken it by retarding the growth of the stem. It seems to be most abundant in damp ground. The caterpillar is about 1 inch long, of a dirty-green colour with a black head, and is sprinkled over with scanty hairs. It turns into a chrysalis in the rolled-up leaf, and in a few days comes out into a small grey moth belonging to the group Pyralidæ. It is 1 inch wide across the wings, which are grey with yellowish and iridescent reflexions, with obscure darker grey spots in three transverse wavy bands. The margins of the wings are fringed and grey. The antennæ are long and slender yellowish brown, the eyes black, one portion of the legs long with white coxæ, the rest of the legs ochreous-yellowish. The body is white below, but coloured like the wings above.

Extraction and Treatment of the Fibre.—A very large number of machines and processes for extracting the fibre of ramie have been invented, and fresh ones are constantly under trial. Some recent inventions have been stated to be perfectly successful in every way, but, not having seen them actually at work, it is impossible to give any opinion as to their value. The Faure machine, so far, seems to be the most popular one at the present time.* In one form of ramie grown in looses and soil in Penang, it was found that the stems were soft and hollow, instead of woody and solid; and that by beating them with a wooden mallet on a board, the woody fibre could be broken up so as to be easily washed out. Not only was this a very simple process, but more fibre was obtained than by stripping the bark and washing it out, as a considerable amount of fibre remained on the sticks after stripping, which could not be got off. Most ramie sticks are too hard for this treatment, and it remains to be seen whether the softer hollow-stemmed form would not be more valuable to cultivate than the hard form. It may, however, be merely a form due to its cultivation in poor soil, in which case it would probably, in treatment with manure or on planting in richer soil, develop into the stronger woody form.†

Uses.—The fibre of ramie may be said to be the best fibre known for general purposes. It is as strong as, and in some trials has proved stronger than, Russian hemp. It presents an unusual resistance to the effects of moisture, and it is finer than flax. A small admixture of it improves paper, but it is at present too valuable and expensive for use in this way, though waste bits might be disposed of to the paper manufacturers with profit. The fibre has long been used for nets and cordage, as well as for sailcloth, the sails of several of the well-known racing yachts being made of it. It is also used for lighter fabrics, such as silk scarves, dresses, umbrellas, tablecloths, lace, &c. From the various uses to which it can be put, it will be readily understood that the demand is practically unlimited, but it is necessary that the fibre should be produced clean at moderate prices—that is to say, at about £30 per ton. If this could be done, ramie might be extensively cultivated and exported from this region. The waste leaves of the plant form an excellent fodder for cattle, which are very fond of it. The Chinese also, by boiling them, prepare a black jelly, for which there is a considerable sale in Singapore and elsewhere.

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* A later machine has been just introduced into Australia by Mr. Max Rowl, which claims to be efficient; and we hear that the New South Wales Department of Agriculture has purchased one, with which trials will shortly be made.—Ed. *Q.A.J.*

† This was clearly shown in 1877, when ramie grown at Cadarga, Milton, on poor soil, was hollow-stemmed until well manured, when it developed the strong woody form.—Ed. *Q.A.J.*

A fear has been expressed lately in the public journals that, like the *Sida retusa*, nut-grass, &c., the ramie may become an ineradicable pest; but Mr. Soutter, of the Brisbane Acclimatisation Gardens, and Mr. MacMahon, of the Brisbane Botanic Gardens, both declare that there is not the slightest foundation for any such alarm. We have ourselves grown the plant more than twenty years ago at Milton, and during six years the plant never seeded, and was propagated by rooted stems. No caterpillar or other pest was ever seen on the plants, which grew well to a height of about 4 feet in a poor gravelly soil without any manure. There is no visible sign of any disease or caterpillar on the plants in the Brisbane gardens. Instructions have been given to the managers of the Northern State Nurseries to plant a certain quantity of rhea in view of a possible demand springing up for plants, should Mr. Rowl's machine prove to be of practical and economic value.

Mr. Sidney Moxsy, of Jamaica, writing to the *Tropical Agriculturist* on the subject of ramie or rhea planting, replies to three important statements made in an article on ramie in that journal in May last. The statements are—

1. That India generally is not so suited to ramie cultivation as has been supposed.
2. That ramie, when grown in some places there, proved quite unfit for commercial purposes.
3. The ramie cannot withstand a drought.

As these statements are of interest to us in this colony, where ramie may yet be grown profitably (although we doubt it, owing to the absence of the very cheapest labour) if it should be shown that a perfect decorticating machine has been produced, we give some of Mr. Moxsy's replies to the statements.

To No. 1 he replies that one of the chief and most important arguments put to him why ramie is not likely to prove commercially successful in Jamaica is that the enormous quantity that could be produced in India would soon swamp the market, and would be put in at a figure with which they (in Jamaica) could not possibly compete. Now, the above article confutes this statement, and points out that only a comparatively small area in India is suitable for the production of ramie on a business basis. He then points out that owing to greater proximity to a market, with the advent of a successful decorticating machine, the advantage of India would be greatly reduced, if not entirely swept away; whilst as to swamping the market, the innumerable uses to which ramie can be put and the low price at which it could be produced—underselling cotton, jute, flax, &c., and being capable of replacing all these to advantage—make it improbable that the world's supply will exceed the demand, at least in this generation.

The second statement is yet more important. It shows that, although ramie may be grown, it may turn out commercially useless. How is this to be ascertained without putting our locally-grown plant through a machine or process? It is most essential that we should be able to ascertain this before entering into extended cultivation.

The third statement—viz., that "drought will kill it outright,"—is incorrect. In one of the severest droughts ever known in Jamaica (in 1897), Mr. Moxsy cut ramie stalks averaging 3 feet 9 inches in length, and some were cut after three weeks' growth over 4 feet. The plants are two years old. Mr. Allison, a well-known authority on ramie, says, in reference to a Texan ramie plantation:—In 1889 a drought began, which lasted nine weeks. The soil was dried to a depth of 2 feet. Hundreds of thousands of coffee plants perished, but ramie survived the drought, and, when the rains came, grew with such luxuriance that often 150 stems were found in clusters not more than 2 feet in diameter.

Coffee-growing in the Mackay District.

By D. BUCHANAN.

Manager of the State Nursery, Mackay.

In continuation of my last paper on the above subject, in which I pointed out the possibilities awaiting extensive coffee cultivation in this district, I shall give a few notes on the preparation of seed-beds, on sowing the seed, preparation of the land, planting out the bushes, and their after-treatment.

It is now too late for seed-sowing this season, but the necessary knowledge for this important portion of a coffee-planter's work should be first acquired, and then he will be duly prepared when the time for action arrives. The seed-bed may be said to be the first part of the work required. Choose a place sheltered from the wind and partially shaded if possible; but if such a spot is not on the farm, then some temporary arrangement must be provided, such as a few stakes stuck along the side of the bed with a sapling run along the top on each side, and a few branches laid across. This forms an excellent cover, and the branches can be removed when the plants are up. If it is made 4 feet high, the morning and afternoon sun will get to the bed and warm the soil. Should the bed be of scrub soil, it will not require any addition of sand; but if it be heavy, then sand, if it can be got, should be well mixed with the soil. This will be of great benefit. Some dried cowdung, broken up, added to the mixture will help the young plants to fibre, and will adhere to the roots when planting-out time comes. The seed-bed should not be more than 4 feet wide, a width which affords facilities for weeding from both sides; but if the following directions can be carried out, very little weeding will be required: Make the rows *across* the bed—the distance between them is not of much importance; 6 or 8 inches will do, as a narrow hoe can easily get between either; but what is of the most importance is the depth at which to cover the seed—half or three-quarters of an inch is quite enough. The best way to make the drills is with a piece of board 4 feet long and half-an-inch wide. Press this into the soil to the required depth; a nice even row is thus produced, the bed having, of course, been made perfectly level from side to side. Fill in the row with a little light soil; and when all the bed is sown and watered, then put on 1 inch of chaff—cane tops and trash make the best, as there is no seed in them. I consider this the best plan to ensure a good crop of plants, besides saving a great deal of watering. So long as there is dampness in the soil under the chaff, never think of watering. The less watering the better, provided the soil is damp. If the bed can be covered by chaff, then no erection is required for shade purposes. After the plants have appeared through the chaff, if there is any sign of them "damping off" (rotting)—a trouble which is caused by a fungus—dust the bed all over with sulphur, and water it in after it has had a day's sunshine on it. If the "cherry" has got dry when received, making it difficult to rub the pulp off, put it into a box or tin mixed with damp earth, and leave the seed in it for eight or ten days, when the pulp will be found to be rotten and may easily be rubbed off. Then sift the soil out and sow the seed, not allowing it to get dry. The time required for the seed to germinate will depend upon the heat in the soil, and it is for this reason that I prefer a coat of chaff to any other plan of shading. The sun shines on the chaff and warms it, the heat reaching to the seed; but where there are 3 or 4 feet of space between the shading material and the soil, it will remain cold and the seed will be much longer in coming up;

in any case, not many plants will be seen under three months. Six weeks ago a farmer came in who had sown seed a month previously. He had begun to despair of its coming up, and others may share the same fear; but there is no reason for such doubts, as the seed must have its allotted time to germinate.

I have been asked the question, how old the plants should be before they are planted out. No definite answer can be given to this; when the plants have got four leaves besides the seed leaves, they are then large enough to handle; but, as to planting them out, that must depend upon circumstances. If the ground is dry, and there are no signs of rain, and if watering is not possible, then the work must be deferred; but where it is possible to water, even with a large amount of labour, the sooner the planting out is done the better. The next best thing is to make up another bed, which will require to be much larger than the first seed-bed, and transplant into this bed, giving the plants more room than they had in the seed-bed, pinching off the point of the tap-root. This may seem unnecessary labour, but it will amply pay in the end. If the seedlings have been transplanted before they are permanently set out, there will not be many gaps to fill up. The pinching-off of the point of the tap-root causes them to fibre, a condition which has much to do with the ultimate success of the plantation. If this plan be followed, you can wait till the land and season are both suitable.

As regards the preparation of the land, if it can be worked by the plough, then plough as deep as the good soil will allow, and keep a skeleton plough following to break up the lower soil as much as possible. After the land has been thoroughly cleaned and rolled smooth and marked out, the planting then can be done by a garden trowel. Plant diagonally, to insure the possibility of the horse-hoe doing most of the keeping clean for several years; but, where mulching can be done efficiently, neither horse nor hand labour will be required. I know that mulching can only be done by a cane-farmer who has a few acres under coffee. Where the land is scrub, full of stumps and probably stones, then the holing system must be adopted, but, where possible, I would still keep the plants in diagonal rows. When the plantation is to be on the side of a hill, and there are as many boulders as soil, then it will pay to terrace the whole, following the undulations of the surface so as to keep the terraces as nearly level as possible. It may be thought that this would be a very expensive work, but it is not so. With a proper tool, stones lying on the surface, and even when they are partly buried, are easily pulled down the hill and left in a row, making these rows 8 feet apart and the soil levelled down so as to have a level surface from one row of stones to the other. The advantage of this plan will be felt, as long as the plantation is in existence, in preventing the washing down of soil in a district where 6, 12, and even 17 inches of rainfall in twelve hours, as it has done here. Where a plantation is on the side of a hill and the incline is steep, washing down is a certainty; open ditches, where they are run with not much fall, will help, but they must be pretty close together to be effective; and the opening of these costs money, and keeping them open is a job that will last as long as the plantation, and in the end will have cost more money than terracing. But no hard-and-fast rule can be laid down in the preparation of a plantation—circumstances must be obeyed, and of course it is just here that a mistake may be made, and a start effected on the wrong lines. If the land is level, by all means do your preparation with the plough; but if on the side of a hill among stumps and boulders, then a different plan must be pursued, and it will be for the farmer to consider whether or not there is a chance of his soil being washed down. In such a case, he must adopt the best plan of preventing the calamity. In Scotland and on the Island of Arran, I have seen magnificent silver firs growing on the bare rocks, their great boa-constrictor-like roots clasping these rocks where not a particle of soil is to be seen within many feet of them, but there had been soil there, if it was but in the crevices, when the seed vegetated, and before these wandering roots found openings to get below. But the coffee-bush has no such roots, and could not withstand such circumstances.

Whatever may be the mode of preparing the land or of planting, the width between the rows, growing the plants to single or more stems, manuring, or any other system, I consider *disbudding* to be the mainspring of success. Keeping the bushes in good form and in a condition to bear large crops of fine cherry will depend entirely upon this process being carried out. I do not know whether or not this is recommended in any of the books extant on coffee cultivation.* Anyone who has cultivated peaches on walls in the old country can see the reason for this disbudding. Coffee, cherry, and peaches are borne on last season's wood; the peach shoot may be 10 inches long, and on it there are as many buds besides its flowers. If there is no more wall-space to cover, there is only one of these buds required, and that is the one at the base of the shoot now bursting into flower and wood. All the buds are therefore pulled off, except the one at the base. There may be as many fruit "set" as there are buds to be pulled off. These are also reduced to one; as this undisturbed shoot grows, it is laid close to the wall, and at the winter pruning the shoot that has borne the fruit is cut away and the new one takes its place. If there is wall-space to cover, the terminal bud is allowed to grow; if not, the point is pinched out at four leaves. Now this is just about what is required to be done with the coffee-bush. To-day I measured a bearing shoot for this season; it was 2 feet 3 inches long, and had twenty-one joints. That means forty-two leaves. The axil of each of these leaves is crowded with flower-buds and also with shoots, so that there are forty-two shoots. As only one or three of these at the farthest is required, it follows that there will be about forty shoots in the way, and these must be removed, and the same mode of procedure adopted as in the peach. The bud at the base must be saved; and as there are generally more than the two laterals at the base, by all means save the one that is on the top, and that will grow out in a line with the shoot upon which it is growing; but if there is not a starting bud either above or below them, one of the lateral ones must be saved, but they have a tendency to grow across the other branches. If the bush is large enough to occupy its allotted space on the ground, the point must be pinched out of the bearing shoot, but, if the bush is not full-sized, then the point must be allowed to grow and a lateral to fill up the widening circumference. It will be very plain that, if all the forty-two were allowed to grow, there would be little chance of any of these shoots growing to a length of 2 feet 3 inches; indeed, there would be a thicket of tiny useless "wood." It may be thought they can be removed at pruning time, but what a waste of energy, and what would be the strength of those left? Indeed, when disbudding is followed, little or no pruning is required; the whole vital power of the plant has been engaged in producing the "wood" required, and there has been no waste of power. It may be thought that this would involve a large amount of labour, but it does not require so much labour as pruning at what is called pruning time. Again, the tyro may think that is an operation requiring a good deal of study and experience, but the thing so explains itself that any intelligent man, woman, boy, or girl may learn it in a few minutes; and the farmers' boys and girls when they return from school, by spending a half-hour or so, will do a great deal towards it, and they must be paid for the job, and by the job. Now, a few words about doing the work. If the shoot has "broken" its buds, a glance will satisfy the operator as to the one, two, or three which are to be left. If they have only two young leaves, they will break off easily; but if they have got four leaves, they must be cut—the finger and thumb only are required to pinch off, so that a knife can be held by the rest of the fingers. A penknife is the best. In pinching they must be all bent downwards, for, if bent upwards, some of the flower-buds will come with them, but when bent down no buds will be destroyed. As all the shoots do not "break" their buds at the same time, the bushes must be gone over several times. In rich scrub

* The practice is recommended by H. A. A. Nicholls, M.D., F.L.S., in his "Text-book of Tropical Agriculture"; also in the "Coffee Planter's Manual" (J. Ferguson, editor of the *Ceylon Observer and Tropical Agriculturist*), under the head of "Handling."—Ed. *Q.A.J.*

soil, no manure may be required for years; but where the soil is poor, then manure is necessary, and all that can be saved from either horse or cow should be applied. I once passed the place of a farmer who kept a good many cows. He had taken the trouble to cart out the manure from the stockyard and place it round the stems of the trees near the buildings to kill them, and it had done so, while he had about half-an-acre of sorghum in seed and about 3 feet high as yellow as a duck's foot. I do not think there are many farmers who would act so unwisely, but, still, manure is often wasted. The ashes from the fireplace, if carefully saved, would do much in the course of a year. I have been asked several times which is the best kind of coffee to grow. Some have been told that the Liberian is the best, and some Mocha. My advice is, Stick to the Arabian and let the other sorts go. If these few simple instructions are carried out, I do not think there will be much disappointment.

B 1

Coffee in North Borneo.

FROM the *Sugar Journal* (Mackay) we take the following remarks on coffee in North Borneo by Mr. W. B. Pryer in the course of an address before the London Chamber of Commerce:—

The coffee grown in North Borneo is the Liberian sort. It grows faster and is healthier and larger in North Borneo, as far as I can discover, than in any other country; and it finds a ready sale, the present price being about 64s. per cwt., against 40s. for good Channel Rio (Arabian). The following are the actual crop figures from a 170-acre estate:—

			Piculs	cts.
Before	24 months old	... ...	1	96
Six months	25 to 30	,, ...	40	02
,,	31 ,, 36	,, ...	130	35
,,	37 ,, 42	,, ...	220	19
,,	43 ,, 48	,, ...	304	13
Three months,	51, 52, 53	,, ...	359	66*

This is of clean marketable coffee. This estate has not been manured—a significant testimony to the richness of the soil. Labour costs 30 cents or 7½d. per day for each working day, with no extras of any kind, the men housing themselves and finding most of their tools. It is free labour, which is in increasing supply as demand increases.

* 1 Picul = 133 lb., which is equal to nearly 24 tons at £64 per ton = £1,536.

The Queensland Sugar Industry.

In view of the present position of the sugar industry in Queensland, the following extract from the letter of an anonymous writer ("N. C."), addressed to the *Brisbane Courier* on the 27th September, cannot fail to be of general interest:—

No one can deny the value of the Queensland sugar industry. There are nearly 90,000 acres under cane. The value of the annual production of sugar is close upon £1,000,000. There are between seventy and eighty sugar-mills in operation, and 8,000 white hands directly employed in the manufacture and growth of the cane. There are also 8,000 coloured men employed as labourers. The value of the manufacturing plants is nearly £1,500,000 sterling.

In March of last year, Professor Dr. Pausche, speaking from his place in the German Reichstag, said: "The fight between cane sugar and beet sugar which prevails in the sugar market of the whole world must come to an end somehow or other. One of the two only can be the victor; the other must succumb, if not completely, yet sufficiently to put an end to the mismanagement in the colonies. I wish that our sugar industry may become great and strong, and I hope that we gain the victory over the colonies; and, if the bounty can do anything to bring us nearer to this aim, even though incurring worse times for ourselves in the beginning, we can say at last, when the market is at our command, 'We have pursued a grand policy, and we have reached a grand aim.'" The language is clear enough. The destruction of the sugar-cane industry has been decided upon. This may seem a dream, but "to-day's dream is a fact to-morrow." I shall endeavour to show that the dream of our patriotic German friend is about to be realised.

The present depression in the cane-sugar industry of the entire world is caused, of course, by the fall in the value of sugar of some £15 per ton during the last twenty years or so. To say that this striking event is due entirely to bounties, would, of course, be mere nonsense. More general reasons have to be sought, and one of the most important of these is to be found in the enormous relative increase in the saccharine strength of the beetroot, and the improved processes, which have not only led to the production of sugar at half the old prices, but have prevented the hitherto enormous waste of sugar during the process of manufacture. But the increased sugar content of the beet and the improved methods of manufacture are not sufficient to account for the depressed state of the industry. If these were the only causes, I would say by all means let the British planter go to the wall if he does not exercise the same care as his Continental rival. What the British planter complains of is the artificial methods that are adopted by his foreign adversaries to crush him. Let us examine these methods. I shall have to go into figures, but I shall condense as much as possible.

The position of the three largest producers on the Continent—namely, Germany, Austria, and France—is as follows:—

	Production in Tons.	Excise Duty.	Export Bounty.
Germany	1,820,000	£6,500,000	£1,600,000
Austria ...	1,000,000	3,200,000	900,000
France ...	765,000	10,500,000	2,500,000
Totals... ...	3,585,000	£20,200,000	£5,000,000

The Excise duty collected by the different Governments is roughly £20,000,000, out of which £5,000,000 is returned to the sugar-makers in the form of bounties for sugar exported to foreign countries. The total export of the three countries named is about 2,000,000 tons, while they receive in bounties £5,000,000, or, say, 50s. per ton for every ton exported. Now, as an Excise duty of nearly £6 per ton is collected upon the whole production, while the bounties paid upon the whole production amount to about 30s. per ton, it would appear at first sight that the producers paid to the Treasury £15,000,000 more than they received in bounties. So they do. But they take care to recoup themselves over and over again from the consumer. And this is how they manage it. The consumption of the three countries named is 1,470,000 tons. By a protective tariff the value of sugar is kept about 3½d. per lb. higher in the Continental markets than in the English market. Now, note the result. Multiplying the total home consumption—namely, 1,470,000 tons—by the extra value received through protection—namely, 3½d. per lb.—we have the stupendous sum of £47,375,000, which is practically a gift from the consumers to the producers to enable them to carry out their nefarious schemes to crush the cane industry. The actual bonus, therefore, received by the Continental producers is equal to nearly £10 per ton on every ton of sugar produced. It is made up thus—

Amount received from producers	£47,375,000
Amount received from bounties	5,000,000
	£52,375,000
Less amount paid by Excise	20,000,000
Total	£32,375,000

Received on a production of 3,585,000 tons.

I have gone to some trouble to make the position clear to the general public. Let them imagine a bonus of £10 per ton paid upon an article which sells in the open market, say, at an average of £11 per ton, and then ask themselves can the Queensland industry fight against such odds? Surely not. It may be taken as a fact at the present time in the largest and best-equipped factories here and the ruling rates for cane, it costs just about as much to produce the sugar as is obtained for it in the greatly protected markets of the colony. The present is bad, but the future is infinitely more gloomy. New South Wales is degenerating into freetrade, and one of our largest and best markets is to be handed over entirely to the bounty-fed producers. This is no idle statement. German producers, by means of their large steamers now trading direct to Sydney, are now offering to land best refined sugar in Sydney at £12 17s. 6d. per ton. When this takes place, Queensland producers will be compelled to sell their refined article in the Sydney market at £2 per ton less than it costs to make. This is a serious matter.

After the experience of England, where her grand sugar refineries have almost become things of the past through the competition of bounty-fed sugar, surely we are not going to allow a repetition here. Your answer to this is perhaps that cheap sugar has established other subsidiary industries which more than make up the loss of the refineries. Just so. But my reply is that, but for the bounties, England would have had her refining industry and the subsidiary industries into the bargain.

Then, again, look what America is doing. She imports annually about £2,000,000 worth of Continental sugar. She is now determined to grow beets herself, and keep this money amongst her own people.

During the last three or four years the production of beet sugar has increased fourfold. The Chief Department of Agriculture in the United States has lately supplied 20,000 farmers with seeds of sugar beets free of cost. When men like Claus Spreckles, the sugar king, and the American Sugar Trust have begun to push the industry, it is time for us here in Queensland to ask ourselves what the effect will be when America grows all her own sugar, and the Continental sugars are diverted to our markets. It means that our industry, with its expectations of future greatness, must go to the wall. It means the ruin of hundreds of deserving colonists—ruined to make a German holiday. And what industry is to take its place? What is to become of the thousands of workers who derived their means of livelihood from this industry?

These are questions I cannot answer. I hope they may never require an answer. I hope the remedy may be applied before it is too late.

Supposing by the shutting out of bounty-fed sugar the consumer has to pay ½d. per lb. more for his sugar, what is it? Assuming the average consumption per head at 80 lb. per year, ½d. per lb. is only 3s. 4d. per year per head. Surely a trivial payment in comparison to the loss of a great agricultural industry.

Sugar-cane Tests at Mackay.

REPORTS from the Northern State Nurseries at Mackay and at Kamerunga, Cairns, are to hand; and amongst much valuable information as to work done during the year, number and condition of trees and plants, crops gathered, and seed and plants supplied to neighbouring farmers and planters, we note the remarks concerning the experimental sugar-canes, and the method of dealing with them. All new varieties of cane received from New Guinea, Kew Gardens, and elsewhere are planted separately, and their habits are watched carefully whilst they are growing, any peculiarity being at once noted down. When these canes have arrived at maturity, or when ready for distribution, they will be tested as for mill and field before distribution is made to those engaged in this industry. Application was made at the Mackay Nursery for plants of the New Guinea McLean cane, but as it had not been tested the manager very properly refused to supply any plants, especially as during 1895 this cane did not show very favourably. This year it has done exceedingly well, so much so that a request was forwarded by the Department of Agriculture to Mr. Seeliger, chemist at the Homebush Mill, Mackay, asking him to analyse that and some other New Guinea canes. Mr. Seeliger promptly complied with the request, and forwarded the results of his analysis as follows:—

ANALYSIS OF NEW GUINEA CANE MCLEAN.

Cane sugar	16·66	per cent.
Fruit sugar	·24	„
Other organic matter	1·21	„
Total soluble matter...	18·11	„
Fibre	10·90	„
Water	71·71	„
Quotient of purity	92	„

In 1894-5, large quantities of New Guinea canes were distributed. As there was then no chemist attached to the Department of Agriculture, and the laboratory of the Government Analyst not being equipped with the necessary apparatus, the Colonial Sugar Refining Company very kindly granted the services of Mr. G. E. Holroyde, chemist at the company's refinery at New Farm, to make an analysis of some New Guinea canes before they were sent out to the planters. The first samples submitted to that gentleman were the "Batoe" (N.G.), and also a seedling cane then just received from Kew, and named "Kewensis."

The following is the analysis arrived at by Mr. Holroyde:—

ANALYSIS OF SEEDLING CANE GROWN AT MACKAY.

Name of cane, Kewensis.

Total solid matter	22·75	per cent.
„ Cane sugar	19·60	„
„ Fruit sugar	1·93	„
„ Density	12·6	„

ANALYSIS OF JUICE OF NEW GUINEA CANE (1ST RATOON).

Variety, Batoe; age, about ten months.

Total solid matter	20·80 per cent.
„ Cane sugar	16·85 „
„ Fruit sugar	2·56 „
„ Density	11·5 „

Deterioration by keeping the cane or juice has, no doubt, taken place to the extent of probably 2·7 per cent. of cane sugar.

ANALYSIS OF NEW GUINEA CANES GROWN AT MACKAY; AGE, FIFTEEN MONTHS.

VARIETY.	OORAYA.	CHENOMA.	IDUARI.	ARABORA.	BATOE.	MAHOAOVA.	KIKERIA.	OIVA.	KEW SEEDLING.
Plants or Ratoons.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Plants.	Third Ratoons.
Cane sugar	16·18	11·66	16·80	14·51	12·91	9·88	10·89	14·34	18·32
Fruit sugar	·45	·69	·30	·57	1·08	1·93	2·03	·57	·17
Other organic matter and ash ...	1·55	1·28	1·50	1·23	1·61	2·00	1·67	1·41	1·83
Total soluble solids	18·15	13·63	18·60	16·31	15·60	13·81	14·59	16·32	20·32
Fibre	13·54	12·12	12·50	13·48	8·83	9·94	8·39	12·25	9·33
Water	70·40	73·91	69·66	73·32	75·90	77·11	77·25	73·13	71·00
Quotient of purity	89	86	90	89	83	72	75	83	90
Pure obtainable cane sugar ...	15·19	10·67	15·90	13·61	11·57	7·91	9·04	13·35	17·32
Estimated crop per acre (tons) ...	28·30	28·30	28·30	28·30	28·30	20·00	20·00	20·00	...

Inoculation for Tick Fever.

THE PROSPECTS AND PROBLEMS.

By J. SIDNEY HUNT, M.R.C.S.

"What are the prospects of our being able to protect our cattle from tick fever by inoculation?" "Have the experiments made in this direction been successful?" "Is the evidence yet sufficient to warrant us in forthwith inoculating our herds?"

These are questions which are being anxiously discussed on all sides amongst stockowners. Unfortunately, they can none of them be answered in a sentence. And for this reason it is hoped that a brief survey of some of their more important features will not be unacceptable to those interested.

What are our grounds, then, for thinking that inoculation of any kind will be protective against tick fever? In the first place, we have abundant evidence that cattle that have survived prolonged exposure to virulent tick infestment* become possessed of a power of resistance to the fever much greater than that of normal cattle. This is a familiar observation in respect to the cattle in the permanently infested areas of the United States, and, in perhaps a less marked degree, to the cattle on Queensland runs through which the disease has already passed. If no such increased resistance were acquired in cattle perpetually exposed to ticks, it is evident that the herds, in all permanently infested places, must, eventually, be exterminated. And we know that the very opposite of this is actually the case. In the permanently infested Southern States of America, cattle-raising is now a more important industry than ever. There is practically no mortality from tick fever; and the disabilities suffered by the industry from the presence of these parasites are confined to the difficulties of marketing the cattle into clean areas, and of importing high-class animals for the improvement of southern herds. Moreover, in the case of Queensland cattle, increasing experience is steadily adding to our confidence† that a like increased resistance succeeds the first disastrous waves of the specific fever which, sooner or later, follows in the wake of recent tick infestment.

This increased resistance is often, for convenience, spoken of as *immunity*. It should be, at once, indicated, however, that by "immunity," in this connection, is meant only such a degree of increased resistance as to amount to *practical immunity under ordinary conditions*. It is perhaps open to question if absolute immunity is ever acquired by cattle against tick fever. For it is a common observation in Queensland that herds through which the disease has passed may, though still tick-infested, be perfectly healthy on their own runs. Yet when such cattle are subjected to the hardships of droving, especially in bad seasons, a certain percentage will sometimes succumb to the disease. Unfortunately, we do not, in fact, know whether such mortality occurs in consequence of fresh tick infection, picked up on the stock routes, and affects only such animals as have, for some reason, previously escaped the disease, or whether it is in reality due to a second attack of fever, brought about by fresh tick infection in animals that have, indeed, already had the disease, but have not thereby acquired the necessary degree of resistance to withstand a fresh infection under the trying conditions frequently encountered on the stock routes. Or, again, for all we know to the contrary, the mortality

* By "virulent tick infestment" is meant tick infestment which in any given place is known to be accompanied by acute tick fever.

† Immune cattle are to-day of greater selling value than susceptible ones. And, as Herbert Spencer points out, there is no surer test of such matters than the commercial test.

may be due, not to any fresh tick infection at all, but to the direct effect of such adverse influences as exertion, privation, and exposure, in rekindling, as it were, the fires of fever which have been lying dormant in their blood, or, as drovers say, "in bringing out the disease." But we know that persons who have suffered from malarial fever are very apt to get fresh attacks, apart from fresh infection, under the like unfavourable conditions.* No one, however, on this account, doubts that a certain degree of immunity is acquired by persons residing in malarious districts. And if it can be definitely shown that droving, in conjunction with, or apart from, fresh tick infestment, brings out the disease in animals that are immune on their own runs, then we shall have to recognise two grades or degrees of immunity—station immunity and road immunity.

The broad fact that this increased resistance—"immunity" in its various degrees—is, actually, brought about in Nature, is by far the most important ground for anticipating satisfactory results from inoculation. If no "immunity" were established in Nature, then, assuredly, it would be vain to anticipate that such a condition could be established by any artificial means, such as inoculation. The second reason for sanguine anticipations is that the disease, which is followed by "immunity," when brought about in Nature by ticks, can be equally well produced, artificially, with a syringe. These are the two cardinal points. On them depends the whole hope and the whole theory of protective inoculation. The practical value, however, of these facts lies very largely in the application thereof; and the many inoculation experiments that have been undertaken may be regarded as, essentially, efforts to apply these cardinal facts, in their various details and circumstances, to meet the exigencies of the situation.

If blood be taken from an animal suffering from acute tick fever, and injected into the vein or beneath the skin of a susceptible one, an acute attack of tick fever results. And the disease may be thus passed on from animal to animal without any apparent diminution in virulence. Cattle that have survived the disease, thus intentionally brought about, are found to be immune to subsequent attacks from further injections of virulent blood; and there is evidence that they are also, at any rate, highly resistant when exposed to prolonged and virulent tick infestment. Unfortunately, the mortality which has attended the disease thus artificially set up has been almost, if not quite, as great as that attending the most virulent tick infestment. Hence it is obvious that this method of direct inoculation with blood of an acutely diseased beast cannot, without some modification, be employed as a means of securing protection. A milder expedient must be found. The blood used for inoculation must be in some way weakened or attenuated. Inasmuch, however, as the micro-organism of tick fever† has not been found susceptible of artificial cultivation after the manner of the microbes of many bacterial diseases, the methods of attenuation employed in such cases are not applicable. And as tick fever is apparently an exclusively bovine disease, it is not practicable to seek to attenuate its virulence by passing it through the organism of some more resistant animal, as can be done, for instance, in the case of anthrax, by passing it through the organism of a dog, which is known to be very highly resistant to that disease.

A way out of these difficulties, however, seemed to be indicated by the remarkable observation, made at the Experimental Station at Washington, that the blood of a certain cow, that had been brought up from one of the permanently infested Southern States, was, still, after a number of years' sojourn in clean country, capable of setting up fever when injected into susceptible cattle.

* Some striking instances in illustration of this fact have recently come under the notice of the writer, in the case of persons returned from New Guinea after severe attacks of malarial fever. A few days' hard work on the Winton Railway extension works has, in several instances, sufficed to bring back the fever, with an abundant development of the intra-corpuscular form of the malarial plasmodium.

† Now generally regarded as a *hæmatozoon*, an order of things belonging to the lowest order of animal life.

Here, apparently, was the very attenuation desired—brought about, by a natural process, in the blood of immune animals. For it seemed only reasonable to suppose that, though the microparasite was thus shown to persist for a very long time in the blood of an immune animal, it must exist there in a comparatively mild or non-pathogenic form, since it was absolutely innocuous to its host.

This, then, was the basis of the idea, which has recently been developed in Queensland, of using the blood of a recovered (immune) animal for inoculating purposes.

The first point in pursuance of this idea was to obtain, by independent experiment, confirmation of the Washington observation, that the blood of a recovered animal was actually capable of setting up fever in a susceptible one. The second was to ascertain whether the fever (if any) was of a mild or attenuated kind; for it seemed by no means irrational to conjecture that, though the micro-organism was, apparently, as it were, held in check, and rendered harmless in the blood of an animal in which immunity had been established, it might still spring again into virulent activity when introduced into that of another, in which this condition did not exist.

To carry out these objects it was, obviously, essential that experiments should be made with the blood of an animal that was known to be "immune" on the one hand, and with cattle that were free from all suspicion of past or present tick infestment on the other. Accordingly, two animals, that had survived attacks of acute fever in a virulently tick-infested spot in the North, were cleansed and shipped south of the infested area, and varying quantities of their blood injected into a number of susceptible cattle.* The result was a sharp attack of tick fever in the majority of the animals operated on—so sharp indeed that as many as 10 per cent. of them succumbed. It is worthy of note that the microparasite of tick was, after microscopical examination, reported to be present in greater or less extent in the blood of all these animals; and it was subsequently found that the blood of these in turn was capable of setting up the like fever in other susceptible animals, and the blood of these again in yet others; and that, as in the case of virulent blood before referred to, no obvious diminution in the severity of the disease resulted from this transmission through a series of animals.

A similar experiment carried out amongst (presumably) clean Northern cattle† showed that, amongst these also, the injection of "recovered blood" caused, in many cases, a sharp rise of temperature. The positive results obtained in both these experiments substantially confirmed the Washington observation as to the pathogenic power of the blood of immune animals from infested place.

The premises being so far established, it remained to ascertain if the practical inferences that had been drawn from them could be verified—*i.e.*, if cattle in which the fever had been produced with "recovered blood" were subsequently immune.

The answer to this, if not equally definite, was, at least, very encouraging:—Of the animals inoculated by this method in the South, only 14·8 per cent. had fever when they were subsequently sent North‡ and exposed to virulent tick infestment, and 3·4 per cent. of the number died; whilst of other animals of the same class, that had not been inoculated at all, or had been inoculated otherwise than with "recovered blood," *all* suffered from fever, and 23·2 per cent. died.

In the case of the Northern animals experimented on, none of those inoculated showed any fever when subsequently exposed to tick infestment, and also injected with virulent blood; whilst of the controls similarly tested no less than 75 per cent. had fever, though none died.

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* At Mundoolun, on the Logan. † At Glendower, on the Flinders.
‡ To Inkerman.

By the light of such results, the prospects of inoculation for tick fever—and of the method of inoculation with recovered blood particularly—can hardly be regarded as otherwise than extremely promising. The basis of definitely established experimental evidence is, still, too small to warrant more than this. Quite a considerable number of experiments have, however, been instituted, by various stockowners, since those above referred to were carried out. Some of these have been of a small and tentative kind. Others have been carried out on what may be called a commercial scale. In some instances two, and even three, hundred cattle have been inoculated at one time; and on one station* alone more than 2,000 head have been already treated. It may probably be quite safely said that not less than 3,000 head of cattle have been so far subjected to this process in the North. Further inoculations are also being carried out in the South†, on behalf of the gentleman to whose persistent energy is chiefly due whatever improvement there is in the present outlook for Queensland cattle. Such experiments are of peculiar interest and value, because they have been undertaken under a great variety of conditions in respect to locality and climate, and also in reference to the state and antecedents of the animal supplying the blood, and of those inoculated with it. Many of these experiments have, so far as they have gone, given promising results.

Thus, in one of the most recent of these experiments, no less than 261 head out of 286 mixed cattle, inoculated with recovered blood, showed obvious fever in consequence. Three out of the whole number operated upon have died. Four more are still, at the time of writing, in a precarious condition. The rest have recovered.

The efficacy of the inoculation, in all these extensive trials by private individuals, has still to be tested. Such trials, it is needless to say, have not been undertaken solely for experimental purposes; and the crucial test will only be applied by contact with the advancing wave of virulent disease. Judging from the evidence already before us, however, there seems small reason to doubt that a very materially diminished mortality will reward those who—instead of vaguely hoping for protection by the hand of some *Deus ex machina* in the shape of some accidental circumstance, as elevation, soil, saltbush, climate, constitutional peculiarities of cattle, or the like—have set themselves betimes to ward off disaster with a hypodermic syringe.

As to the *technique* of inoculation with recovered blood, concerning which inquiries are so frequently made, it may be at once said that there is practically no *technique* at all. All that is necessary is to draw blood from a suitable animal, and inject it under the skin of such as it is desired to protect. A little *mother-wit* and a suitable hypodermic syringe are all that are really needed. Most practical stockmen can bleed a beast without special directions. They can also catch the blood, and prevent it from clotting in the containing vessel, by stirring it steadily with a twig till all the clotting part (fibrin) sticks to the twig—that is to say, till the blood is "defibrinated." A piece of mosquito curtain makes a capital strainer to get rid of any remaining bits of clot that might cause trouble afterwards by blocking up the needle of the syringe. There is then absolutely no difficulty in injecting as much of this "defibrinated" blood as may be desired, under any part of the animal's skin that may be found convenient, and where there is plenty of loose skin. Practice will make perfect in detail. Elaborate instructions tend only to make what is really a very simple matter appear rather an intricate and formidable undertaking. To have seen the inoculation performed is to be a master of the art, so simple is the actual doing of it.

From what has been so far outlined, it is evident that both the theory and the practice of inoculation with "recovered blood" are comparatively simple matters. There remain, however, several questions of practical importance in connection with the subject which are still surrounded by much uncertainty, and to some of these it may be of interest to refer.

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* Mount Pleasant, in Bowen District. † At Mundoolun, on the Logan.

The first question that anyone proposing to inoculate his cattle usually asks this:—"How am I to know what blood to use? What is the essential point in regard to the past history or present condition of any given animal that makes its blood efficient as a vaccine?" And it has to be confessed that our knowledge, in respect to this very matter, is by no means as definite as could be desired. In the first place, it is well known that tick-infested cattle harbour in their blood those peculiar, free, amœboid bodies known as the extra-corpuscular forms of the tick-fever organism; and, so far as our present knowledge goes, tick infestment and this form of blood infection are constantly associated. The bodies in question are also known to be intimately associated with acute tick fever. From these facts it might seem not unreasonable to suppose that their presence is the one thing needful to render blood effective for inoculation purposes. But, in opposition to such an idea, it must be borne in mind that cattle frequently suffer from gross tick infestment (and almost certainly from the blood infection accompanying it) for a long time before they show any outward sign of disease. In other words, though tick infested, they are still susceptible. No inoculation experiments with the blood of such cattle, however, have, so far, been recorded; and, in the absence of any such positive evidence, it is certainly hard to understand how clean cattle can be rendered immune by the injection of blood from these tick-infested ones, since the latter are, as regards susceptibility, in practically the same condition as the clean ones.

The experimental evidence, so far to hand, would seem to indicate that recovery from acute tick fever, rather than past or present tick infestment, is the essential condition that renders the blood effective for inoculation purposes. In one experiment, at any rate, immunity has been established in a number of cattle by the injection of blood from a steer that had never been in contact with ticks, but had recovered from an attack of the acute fever, artificially induced by the injection of virulent blood.

The prolonged exposure of an animal to virulent tick infestment, subsequent to recovery, might be assumed to accentuate the protective power of its blood. And it is certain that the blood of recovered animals that have been so exposed is generally found to contain a much larger number of the characteristic free organisms than that of such as have recovered from artificially induced attacks of the specific fever apart from ticks. Whether there is any corresponding difference in the protective efficacy of blood from these two classes of animals, is not yet determined. But there is little doubt that the blood of the former class is much more apt to set up fever in susceptible animals than that of the latter. For the present it is, therefore, probably the wisest course to use, for ordinary inoculations, the blood of recovered animals which have since been, for some time, exposed to virulent tick infestment. In the case of very valuable animals, more particularly such as are known to be specially liable to succumb to acute tick fever—as, for example, stud bulls—it would probably be a wise precaution to prepare the way for this inoculation by a preliminary injection of blood from an animal that had recovered from the artificially induced disease.*

Now as to the actual state of cattle "infested with ticks but as yet showing no sign of disease": Such animals may truly be said to be in an interesting condition. We know, as already stated, that they harbour one form of the microparasite in their blood. We have some evidence to show that, though they are to all appearance perfectly healthy, their internal organs are not quite in the normal condition,† and for these reasons it seems necessary

* It should be clearly understood that these are merely individual opinions, advanced for what they may be worth. The evidence on this particular point is still somewhat conflicting, and is certainly not such as to warrant any positive statements. The very heavy mortality that has occurred amongst some bulls, recently inoculated at Rosedale in the south, shows the necessity of proceeding with the utmost caution in the case of such highly susceptible animals.

† The average spleen weight of six such tick-infested animals was found to be ·45 per cent. of total body weight as against ·29 per cent. in the case of six normal clean cattle. It is of interest to note also that the average absolute spleen weight of immune cattle in permanently infested areas in the States has been found to be considerably greater than in the case of normal cattle.

that the otherwise simple and obvious explanation—that some cattle ticks are non-pathogenic—should be accepted with considerable reserve. We know, too, as has also been already mentioned, that such cattle as we are considering are still susceptible to fatal attacks of tick fever, and that immunity in them, as in the case of other susceptible cattle (that have never been tick infested), is, in Nature, apparently only attained as the result of more or less acute disease—that is to say, fever, or as in this case it might more properly be called *reaction*, precedes immunity.

Touching the nature of this fever or reaction: It is an old saying that "it takes two to make a quarrel," and the same thing may be very well said of a reaction, which is, essentially, a quarrel between some inimical influence, such, for instance, as invading micro-organisms, on the one hand, and the opposing forces of the animal attacked on the other. In the case of the aphorism one of the parties may be long-suffering, and fail to react even to considerable and long-continued provocation, particularly if that provocation has been of gradual incidence; the time, however, at length arrives when reaction is inevitable—either on account of the unbearable increase of the provocation, or through some casual circumstance, such as fatigue, hunger, thirst, or excitement, on the part of the long-suffering individual, which determines that explosive social reaction called, in everyday life, a quarrel. After which, as a rule, for a season—often directly proportionate to the severity of the disturbance—there is peace. In the case of an animal exposed to tick infection, it seems at any rate conceivable that an analogous long-suffering characterises the bovine constitution; it does not readily react to the irritation of the ticks, or rather to the microparasites which they carry, particularly when the irritation has commenced gradually. It has been said that a certain amount of reaction—as shown by fever—is the general result of a first invasion by ticks. And when a considerable number of ticks gain access to a beast simultaneously, as in experimental observations, or at nearly the same time, as when a clean beast is put into an infested paddock, no doubt this is the result. But the infection of a beast on its own run is, in all probability, in most instances, a much more gradual process than is generally believed. The first insidious beginnings of tick infestment can rarely be known; and in one instance, at any rate, communicated to the writer on excellent authority, a herd of 300 dairy cows was under constant observation, being milked twice daily, during the three months that ticks were known to be advancing upon them, and yet in no respect could there be detected amongst these cattle the slightest indication of febrile disturbance. However these things may be—and they are here only referred to to indicate the nature of some of the mysteries which still surround the subject, or rather of some of the problems which still remain to be solved in connection with it—the evidence so far to hand would seem clearly to indicate that *reaction* plays a large and, perhaps, essential part in the establishment of immunity when brought about in Nature. In any case, the only immunity we know of under natural conditions is that which is brought about as the result of more or less acute disease.

How stands the matter in the case of inoculation with "recovered blood"? Is reaction here also essential to success? From what has been already stated as to the considerations which induced the writer to suggest the blood of a recovered animal for inoculating purposes, it will have been understood that the fundamental principle of the idea was to bring about a mild attack of fever which should protect from a subsequent virulent attack. The mild initial attack was regarded as the necessary antecedent of subsequent immunity. Actual experience of inoculation by this method, however, has not, invariably, confirmed these anticipations. In some instances, as in the experiments already referred to at Mundoolun and Glendower, and in a larger and more recent one at Mount Pleasant,* a distinct febrile reaction has

* More than 2,000 head of cattle have already been inoculated at this station alone.

resulted from the injection of "recovered blood." In other instances, however, no such reaction has been discoverable; as witness the case of ten head of tick-infested, mixed cattle, inoculated by Mr. Robert Archer,* which showed no reaction whatever when injected with doses varying from 80 to 240 minims† of recovered blood; and also the case of another experiment, recently carried out at Hughenden, where fourteen head of clean, susceptible, mixed cattle showed no reaction from the injection of 4 c.c., and subsequently of 16 c.c., of blood from an animal which had but just recovered from a very severe attack induced by the injection of virulent blood.

That a very considerable protection was conferred in these cases, in spite of the total absence of all discernible reaction, is almost certain; for when the ten head inoculated by Mr. Archer were subsequently exposed to virulent ticks, along with an equal number of controls, three of the former and nine of the latter succumbed to tick fever. This result cannot, perhaps, be regarded as very successful, but a difference of 60 per cent. in favour of the inoculated cattle must be regarded as unquestionable evidence of the protective value of the process. As to those inoculated at Hughenden: When eight of them, together with one control cow, were tested by the injection of virulent blood, none showed any rise of temperature except the control cow. Her temperature reached 107 degrees Fahr. on the thirteenth day, and at the time of writing she seems likely to die.

These experiments seem to indicate very clearly that the protective value of recovered blood cannot be gauged by the amount of reaction it causes. They also seem to suggest that its efficacy may be due, in part at any rate, to the presence of some abnormal product or products analogous to the *anti-toxins* of bacterial diseases. This question is still shrouded in mystery. The difference between the blood of susceptible cattle and that of immune cattle is too subtle to be recognised by any physical tests. But it must obviously be a very profound one. In the ordinary course of things, we have reason, from analogy, to believe that the change is brought about by a specific *reaction*. Where, however, immunity is brought about in the absence of reaction, as in the experiments just mentioned, it seems possible that, as has been suggested to the writer by Dr. J. H. Connoway of the Missouri University, products differing from the normal, even though not rising to the dignity of *anti-toxins*, may be present in the blood of recovered animals, and these may, possibly, have some share in bringing about the development of the like protective products when injected into susceptible animals. Here, however, are problems awaiting solution!

In regard to this question of possible *toxins* and *anti-toxins* associated with tick fever, it may be remarked, in passing, that, if the views that have been suggested as to the nature of *reaction* are accepted, it can hardly be supposed that any pure *toxin*, or pure *anti-toxin*, is present in the blood of acutely diseased beasts. The micro-organisms might be assumed to produce a *toxin*, and the vital resistance of the animal invaded an *anti-toxin*. Yet, in the violent reaction of opposing forces which constitutes tick fever, it can never be possible to foretell which will get the upper hand, or at any given moment to say definitely whether the attacking *toxins* of the invading microparasites, or the defending *anti-toxins* of the invaded organism are in the ascendant. No reaction in susceptible cattle has been produced by the injection of sterilised‡ virulent blood, which seems to indicate that there is at any rate no *free toxin* present. We have, however, no absolute evidence on this subject. The presence of some substance analogous to an *anti-toxin*, or at any rate of some metanormal product, as Dr. Connoway would call it, may, perhaps, with some reason, be assumed to exist in the blood of recovered animals, because the fact of their immunity, as compared with susceptible animals, indicates that there

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* These cattle were infested with ticks, but were apparently healthy.

† Equivalent to about 4·3 to 12·9 c.c.

‡ The same experiment with *filtered* virulent blood will shortly be undertaken by the Government Bacteriologist.

is some essential difference in their blood, and analogy suggests that this difference depends on the presence of some kind of anti-toxic substance. The long persistence of the microparasites in the blood of recovered animals—as witness the Washington cow—might, at first sight, seem to suggest that if any such substance is present it can only be of slight protective efficacy. This does not follow from the premises, however, because it is well known that even so potent an *anti-toxin* as that produced by the vital resistance of the horse in response to the irritation of the poison of the diphtheria bacillus—*i.e.*, *diphtheria anti-toxin*—has no destructive action on that bacillus itself, but only antagonises, or in some unknown way neutralises, the poisonous *toxins* which the bacillus generates.

The question of hereditary immunity, though beyond the scope of the present paper, is of such great importance that a few words may perhaps be permitted on the subject. What grounds have we for thinking that calves born of immune parents will be immune? Only, in the knowledge of the writer, a single observation to the effect that the specific microparasites (extra-corpuscular?) were detected in the blood of a fœtal calf from a cow that died from artificially induced tick fever. The authorities of the Washington Bureau of Animal Industry are of opinion that there is no evidence to prove that the progeny of cattle in the permanently infested districts are hereditarily immune, but consider that the calves are probably inoculated so young and so constantly in such localities, that they become immune. The facts of the matter can only be ascertained by a series of careful experiments. And the only information that the present writer can contribute on this subject is that the blood of a fœtal calf, five or six months old, taken from a cow that was killed in an advanced stage of acute tick fever at the Hughenden experimental yards, showed no tick-fever organisms, either free or within the corpuscles; and, further, that 24 c.c. of this blood, injected beneath the skin of a susceptible cow, caused no rise of temperature; whilst 2 c.c. of the mother's blood, injected at the same time, for control purposes, into a second susceptible cow, set up a typical attack of tick fever. Very great importance cannot, however, be attached to any single observation of this kind, whether it seems to support or to refute the theory of hereditary immunity. If the cow which failed to react to the injection of fœtal blood should, nevertheless, prove to have been protected by it, it might, perhaps, under the circumstances, be held to suggest that hereditary immunity, if it exists, may be brought about rather by the transmission of acquired (*anti-toxic*) modifications in the blood of the mother, than by the direct transmission of the micro-organisms of the disease. It might also be held to warrant the hope that the milk of immune cows may possess protective properties, as is known to be the case in respect to the milk of some animals immuned to other diseases.

Looking at the whole subject of inoculation for tick fever, it will be seen that, though the prospect may fairly be called brilliant, it cannot as yet be accurately defined on account of the penumbra of unsolved problems by which it is surrounded. The observation of yesterday is often contradicted by that of to-day, and the inferences that to-day seem well grounded have, to-morrow, to be modified by the light of fresh knowledge. This sketch must, therefore, be regarded only as an attempt to represent the aspects of the subject as they appear at the present time.

Hughenden,
9th September, 1897.

General Notes.

THE WANT OF COHESION.

"COMBINATION," writing to the *Mark Lane Express*, says:—"If men will not look after and safeguard their own interests, who is likely to do it for them? On talking over this matter to-day with a very intelligent farmer, he remarked: 'We know well enough that our local farmers' clubs ought to discuss such subjects and take action upon them, but if we were to do so, our societies would lose the support and subscriptions of most of the landlords, and so would come to grief that way.' A thoroughly independent farmers' organisation, for the protection of their own interests and the making of arrangements with first-class manufacturers and merchants for the supply to members on special terms, of all farm and household requisites, would, I am convinced, be good business and soon command very wide support. If the Army and Navy and Civil Services can support large stores that supply their members all over the country with 'cheap' articles, why cannot farmers organise and support a movement which will benefit them in a similar manner? Farmers are being pushed to the wall by combinations of all kinds, and why should they not take the bull by the horns, pay a moderate annual subscription to an organisation of their own, and be able to purchase all their supplies on special terms, through the duly-appointed trade agents of the society? No capital to set up storekeeping would be required, as good terms could be made with agents. Branches could be formed in all large market centres, and the entire control of the local business be in the hands of a farmers' committee. Such committees would be able to take action upon all important agricultural questions, and could call their members together when necessary; and from such committees a general council could be formed that would supervise and direct the movement. Once started upon popular and simple lines, I believe such an organisation would take well and supply a very real need, enabling its members to combine to secure liberal discounts on all purchases, by simply paying a moderate annual subscription to cover the working expenses of their own association."

ZINC LABELS.

BEFORE spraying trees with Bordeaux mixture, it is well to temporarily remove zinc labels, as the mixture injures the labels by producing a zinc sulphate.

SOUPS FROM FRUIT.

FRUIT soups are made from sweetened and thickened fruit juices, and can be made (says *Ladies Home Journal*) from currants, oranges, cranberries, and a mixture of currants and raspberries. Press sufficient fruit to make one pint of juice. Moisten a tablespoonful of arrowroot in a little cold water, add to it gradually a pint of boiling water; add sugar according to the nature of the fruit used. Let this *purée* stand a moment, then take from the fire and add the fruit juice. At serving time fill a punch-bowl half-full of cracked ice, pour in the fruit soup, and it is ready to serve. These fruit soups are usually served at the beginning of a company luncheon.

SCENT FARMS.

IT is matter for surprise that in a colony like Queensland, where sweet-scented flowers can be grown to perfection nearly all the year round, so little attention has as yet been given to the production of flowers for perfumery. The process of extracting the valuable essences from the flowers is so simple that it can be performed by children, whilst the returns are certainly such as to warrant many people trying it. Some years ago, Mr. L.. Carmichael, a well-known

chemist in Brisbane, established a flower garden at Enoggera, solely for the purpose of scent production. He went largely into the business, and included distilling in the work. There are many in Brisbane who can recollect the delicious perfumes he produced. We reprint from the "Cocoon," published by the Victorian Silk Culture Association, a few particulars which may induce some who have flower gardens to try the process recommended for gathering the essential oils of flowers:—

An Experiment with Tuberoses and Lavender.

Throughout Victoria at the present time there are an increasing number of persons who are turning their attention to the production of flowers for perfumery. This indicates that shortly we will be able to produce all the essential oils and scents required for our own market. But still there appears to be a considerable amount of uncertainty and ignorance concerning the right kind of plants to grow and the best methods of treating the flowers.

This deficiency we are trying to supply by obtaining the experiences of those who have made the subject their study.

One of these experimenters is Mr. E. Frost, near Hotham, who during the last six years has tried several plants, and treated them in various ways. He informs us that three years were wasted with lavender owing to wrong information, and by planting the *Lavender spica*, an illustration of which was given in the "Cocoon" for May.

This variety gives an abundant oil, but is of inferior quality, and does not pay to grow.

He finds that the *Lavender vera*, which we recommended in the article above referred to, produces a splendid perfume equal to any imported.

The method adopted is to strip the flowers from the plant when in full blossom. This is done by running the hand along the flower stalk, and can be done easily by children. The flowers are then placed in a small still and steamed for about three hours. The resulting oil is found to be vastly superior to that obtained by distilling the whole of the flower stalk. Practical experience proves that the stripped flowers will yield the best oil of lavender, for which 70s. per lb. was offered in Melbourne.

Tuberoses have also been tried. A small plot of ground 12 feet by 12 feet was treated this year. The flowers were picked as they appeared, and placed upon sheets of glass which were smeared with prepared fat. This was continued as long as the flowers were in bloom, the actual work taking only a few minutes every second day.

The result was 2 lb. of perfumed fat, which was sold in Melbourne at 12s. per lb. The cost of crude fat being only 2s., the net profit was therefore £1 2s. Mr. Frost, however, states that he thinks 6s. per lb. would pay farmers very well, as the picking of the flowers can be done by the children, who can also spread them over the fat and remove the spent flowers. The size of trays used are 16 by 14 inches. The sheets of glass are fixed in wooden frames made from 3 by ½ inch deal. These trays are piled one over the other, and the fat is spread on both sides of the glass ¼-inch thick, leaving ¾-inch clear around the sides. The fat, after being spread, is scarified with a coarse comb, in order to offer as large a surface as possible for receiving the perfume. Mr. Frost recommends this method in preference to the oil process which was described in the "Cocoon" for May.

The single tuberose is recommended, and they are planted in rows 1 foot apart and 8 inches between the plants. They are well watered during the flowering season.

The Rose Geranium, Peppermint, and Lemon Thyme have also been tried, and all do well and yield good essential oil. He recommends growers to plant *Lavender vera*, and to be sure that the plants are from cuttings true to name, and not from seed. Around the lavender field the geranium should be planted in double rows, which will act as a breakwind, and around the beds and along the paths the lemon thyme can be planted, thus using the land to full advantage.

The following are Mr. Frost's instructions for preparing the fat:—Take 12 lb. of fresh lard and 12 lb. of fresh beef kidney fat; melt down in a copper vessel over a slow fire with half a pint of water to prevent burning; strain through a fine cloth into another vessel, and remove the dirt by scraping; then re-melt the fat with twelve cloves in a water bath. Have a vessel of water containing two gallons in which 1 oz. alum has been dissolved from the melted fat into the water, and remove the dirt by scraping. Then take the fat and re-melt it with twelve more cloves in a water bath. When melted, pour again into twelve gallons of water in which 1 oz. alum has been dissolved, and scrape again free of dirt. Re-melt the fat again the same as before in water bath, and pour it into clean water and remove any remaining dirt. It is then ready to be placed into jars to be used when wanted. It is best to paste paper over the jars to keep them air-tight.

Care has to be taken in preparing the fat, for unless it is of good quality and free from all animal odour the perfume will be inferior.

How to Plant the Lavender.—Mr. Frost's method is to take the young growth in the spring about 3 inches long, and with a sharp knife cut a small piece of old wood to form a heel to the slip, which is then planted in nursery rows 4 inches apart in fine sandy loam, pressing the soil firmly around the base, watering carefully and shading from the sun until growth is established. During the summer the tips are pinched back in order to form strong, stocky plants and prevent flowering. In the following autumn, in June, they may be planted out into the permanent plantations, 3 feet apart each way. The following summer the flowers can be cut for perfume.

ORIGIN OF THE COW-PEA.

Having been asked on several occasions what is the origin of the cow-pea and of the name applied to the plant, we have received the following notes on the matter from Mr. F. M. Bailey, Government Botanist:—

It may (he says) be an American name given because cows are fed upon the plant; but more probably it is from "Chowlee," one of the names by which *Vigna Catiang* is known in India. In China the plant is said to be called "Tow-Cok." In South Africa the name given to the plant is "Caffre-bean," according to Mr. Burchall. Baron von Mueller gives "Cherry-bean" and "Cow-pea" as vernacular names for the plant. The name "Vigna" is in honour of Dominic Vigni, a commentator on Theophrastus.

Baker, in Hooker's Flora of British India, gives the following concise description of the species:—

Vigna Catiang, Endl. Low and suberect (*V. Catiang*) or tall and voluble (*V. sinensis*), always glabrous or nearly so. Stipules $\frac{1}{3}$-$\frac{1}{2}$-in. long, attached and persistent as in *Phaseolus*. Leaflets membranous, 3-6 in. long, acute, very variable in shape, broad or narrow, ovate or ovate-rhomboidal, with the two sides below the middle prolonged into obtuse lobes. Peduncles often exceeding the leaves, 3-6 flowered, pedicels very short. Calyx glabrous, under $\frac{1}{2}$-in.; teeth lanceolate or deltoid-cuspidate. Corolla yellow or reddish, twice the calyx. Pod in some of the cultivated forms 1-2 ft. long, under $\frac{1}{2}$-in. broad, edible; seeds 10-20.

Syn.: *Dolichos Catiang*, Linn.; *D. sinensis*, Linn.; *Vigna sinensis*, Endl.; *Dolichos tranquebaricus*, Jacq.; *D. monachalis*, Brot.

Hab.: Native or cultivated in tropical zone. Some think the plant of Malay origin.

CO-OPERATION IN SOUTH AUSTRALIA.

The South Australian Farmers' Co-operative Union, which was started at Jamestown some nine years ago with fifty shareholders, holding not more than 1,500 shares of £1 each, has progressed very satisfactorily of late years, notwithstanding adverse circumstances. In 1893, after a little more than four years' work, the company had between 300 and 400 shareholders, with shares to the value of £3,000, and on this their turnover was nearly £90,000 for the

year. . . . The present capital is £12,753, of which £7,900 is paid up, leaving a calling power of £4,800. In May, 1897, there were thirty-two agencies throughout the colony, and nearly 1,800 shareholders—nearly three times as many as there were twelve months previously. Branches will be established in districts, on forty persons subscribing for a total of not less than 250 shares, upon which 5s. per share is to be paid. Calls are made as further capital is required. In 1896, the Union paid to its shareholders for 175,377 bags of wheat, £151,000; for 3,200 bales of wool, £22,000; for 20,533 bags of potatoes, £5,346; skins, oats, barley, and other produce brought the total for the year to over £180,000. . . . Last year the Union imported 100 tons of commercial fertilisers for shareholders, who were, in consequence, enabled to get it at nearly 10s. per ton less than they would have had to pay if they had purchased for themselves. This year 700 tons have been ordered. Cornsacks and woolpacks are imported in large quantities, and here, again, the shareholders benefit to a considerable extent.—*Journal of Agriculture and Industry of South Australia.*

SUB-DRAINAGE.

In reference to the point raised by Mr. H. Logan, in his remarks on Mr. Watt's paper on Sub-drainage, read at the Farmers' Conference at Gatton, it would appear that Mr. Watt was misunderstood by Mr. Logan. He did not advocate the use of stones large enough to block a drain only intended for pipes. He said that the larger of the stones used should be placed in the bottom. We do not publish Mr. Watt's letter (of which the above is the gist) for the reason that controversial matter does not come within the scope of the *Journal*, which is issued with the sole view of affording useful information to agriculturists, pastoralists, and others.

KIDNEY WORMS IN PIGS.

If anyone has swine weak in the loins, or dragging their hindquarters on the ground, afflicted with what is known as "kidney worms," give them a tablespoon of indigo in thick slop twice a day for three days. If not cured, wait three days and then repeat the dose. I have never known it to fail to cure in eighteen days. Usually twelve doses cure those dragging their hindquarters.—*Australasian.*

BEET SUGAR.

From the *Bairnsdale Advertiser*, we learn that the beet sugar factory at Maffra is making rapid progress, and will shortly be completed. The machinery from Germany is expected in the first week in November, when the fitting up will be begun at once. It is to be ready for making sugar at the end of March next. Meanwhile the sugar beet crops are being got ready. For months past the 1,800 acres intended for the beets have been prepared, and are now in splendid condition. Sowing was commenced a fortnight ago, and the plants are already showing up very nicely. The bulk of the acreage has, however, yet to be sown. The company has obtained from Germany and France the best seed, and is selling it to the farmers at cost price, which is less than 8d. per lb. The quantity of seed sown per acre is 11 lb.

SCHOOL GARDENS.

All children love flowers, and a large proportion of them love to delve in the soil and plant flowers in "make-believe" gardens. This innocent recreation should be encouraged and worked upon until the young are taught to raise flowers in real gardens. Especially in schools can this be carried out systematically. The writer attended a school in Germany and another in Switzerland, where the boys were all allotted small patches of garden ground, and trifling prizes were given for the best and earliest spring flowers and vegetables; and he, on one occasion, took prizes for sweet-peas and balsams grown from seed supplied by the botanical professor. In this colony he carried

out the idea in Eton School, at Nundah. Plots of ground were laid off for the boys; fencing material, tools, and seeds were provided for them; and they were promised prizes for the neatest gardens, the greatest variety of flowers or vegetables, and for the earliest production. A great spirit of emulation was created in this manner. The little gardens were quickly fenced in, dug up, manured, and sown. Daylight and evening saw the busy gardeners watering and weeding, and in due course the first fruits were brought in by three triumphant gardeners. The first fruits were—radishes and mustard and cress. One lesson had taught a few wily market gardeners how to win one of the prizes. Soon these gardens became an institution, and many excellent vegetables and flowers were produced by them. Now, what was done here may be done in all schools having an acre or two of spare land. At present the school children at the State schools enter with great zest upon tree-planting on Arbor Day, and with a little assistance and encouragement they would prove equally zealous in the cultivation of small fruits, flowers, and vegetables. A proof of this lies before the writer in the following article in the *London Agricultural Gazette*, entitled :—

Flower Culture in Schools.—A very interesting addition has been made to the educational work of the Agricultural and Horticultural Association, which has done so much to promote "gardens of taste" by establishing industrial flower shows. The new effort aims at reaching the children in our public schools. During the past spring the Council of the Association commenced by offering prizes for the culture of pot plants to the children in twenty-seven London schools. Prizes were offered for every class, as well as for each school. The flowers to be grown were Tom Thumb nasturtium, candytuft, ten weeks stock, German aster, Virginian stock, and godetia. The prizes consisted of garden tools, floral certificates, and bound copies of the Association's annual, "*One and All*" *Gardening*. Each little competitor was supplied with the necessary seeds and very detailed instructions for carrying out the work, a nominal charge of one penny being made in each case, to give the children a personal interest in the success of their attempts. No less than 1,627 competitors entered, and the results were exhibited in twenty-seven little flower shows before the recent breaking-up for the holidays. So much interest and enthusiasm was shown, that Mr. Edwin Owen Greening, at whose instance the experiment was made this year, hopes to see a great development of the movement in future years. The subject was brought before one of the meetings held in connection with the "One and All" Flower Show at the Great National Co-operative Festival at the Crystal Palace.

AGRICULTURAL COLLEGES.

In the United States of America there are 5,000 students attending the various agricultural colleges, and nearly 11,000,000 acres of land have been granted to these institutions by the United States Government. On a population basis there is one agricultural student for every 14,000 inhabitants. In Queensland, thirty students attend the Queensland Agricultural College, which has a grant of 1,672 acres. On the population basis, Queensland has one agricultural student for every 15,730 inhabitants.

AGRICULTURAL AND HORTICULTURAL SHOWS.

The annual show of the Gympie A.P. and M. Association took place on the 6th October, and, although a two days' show, was practically not closed until the 8th. A heavy wind and rain storm interfered with the arrangements on the first day, but the fine weather on the succeeding days enabled crowds to reach the ground. There were amongst the varied exhibits some magnificent gold specimens from several well-known claims and very good agricultural exhibits.

The spring rose show of the Horticultural Society of Queensland was held at the Centennial Hall, Brisbane, on the 12th and 13th October, and was largely attended, the attractions of music, singing, and living pictures being added to the really magnificent exhibition of flowers.

On the 7th October a successful agricultural show was held at Bundaberg.

For full particulars of these events, we refer our readers to the local daily and weekly journals.

The Editor will be glad if the secretaries of Agricultural and other Societies will, as early as possible after the fixture of their respective shows, notify him of the date, and also of any change in date which may have been decided on.

SHOW FIXTURES.

Central Downs Agricultural and Horticultural Association (Allora)	2nd Feb., 1898.
Eastern Downs Horticultural and Agricultural Association (Warwick) ...	9th and 10th Feb., 1898.

SUGAR-CANE EXHIBITS AT THE LATE INTERNATIONAL EXHIBITION.

In our notice of the sugar-canes exhibited by various planters in the Court of the Agricultural Department at the late International Exhibition at Bowen Park, no mention was made of the cane exhibits of the Colonial Sugar Refining Company from their estates at Homebush and at the Isis. The reason for the omission is that, as these canes were placed in the court some time before our report on the Department's exhibits could be prepared, they had, owing to their condition two months after arrival, to be replaced by fresh canes then recently arrived from other parts of the colony.

Statistics.

GRAIN STATISTICS (QUEENSLAND) FOR TEN YEARS TO 1896.

THE following table shows the quantities and value of wheat and flour imported into the colony during each year from 1887 to 1896, also the production in Queensland during the same period, together with the area under crop and the average produce per acre.

It will be observed that in 1896 the total imports were 50,984 tons, equivalent to 2,447,232 bushels, reckoning 48 bushels of grain to the ton of flour, whilst the production was only 601,254 bushels. The average yield per acre for the ten years was 14·81 bushels, at which rate 205,846 acres would require to be laid under wheat to supply the colony's needs of 3,048,531 bushels. The value of the total breadstuffs requirements in 1896, taking the whole at 3s. 9d. per bushel, was £571,599, of which sum only £112,735 remained in the colony; the balance, plus duty, &c. (which would bring the total to £663,110), was sent to foreign markets.

To-day the quotations per bushel are—Sydney, 4s. 9d.; Melbourne, 5s. 6d.; Adelaide, 5s. to 5s. 2d.; Brisbane, 4s. 7d.

GRAIN STATISTICS (QUEENSLAND) FOR TEN YEARS TO 1896.

YEAR.	IMPORTS—OVERSEA.						TOTAL IMPORTS.	PRODUCTION.*			TOTAL.
	Wheat.*			Flour.*			Grain computed at 48 bushels to the ton of Flour.				Requirements of Grain (48 bushels to ton Flour).
	Quantity.	Value.	Duty.	Quantity.	Value.	Duty.		Area.	Produce.	Average Produce.	
	Bushls.	£	Per Bushel.	Tons.	£	Per ton of 2,000 lb.	Tons of Br'dstuffs.	Acres.	Bushls.	Per Acre.	Bushels.
1887 ...	53,101	9,893	6d.	44,202	443,708	Free	45,308	8,248	182,308	22·10	2,357,105
1888 ...	16,719	2,643	6d.	39,995	386,764	Free	40,343	9,305	8,263	0·89	1,913,742
1889 ...	109,588	22,263	Free	41,371	482,687	Free	43,654	8,459	134,335	15·88	2,229,731
1890 ...	326,484	60,651	Free	41,122	410,191	Free	47,924	10,390	207,990	20·02	2,508,330
1891 ...	261,086	55,671	Free	33,433	353,744	Free	38,872	19,306	392,309	20·32	2,258,179
1892 ...	269,487	53,843	4d.	36,324	390,545	20s.	41,938	31,742	462,583	14·57	2,475,622
1893 ...	372,559	57,659	4d.	34,188	307,778	20s.	41,950	28,993	413,094	14·25	2,426,677
1894 ...	415,734	59,473	4d.	34,003	254,666	20s.	42,664	28,997	545,185	18·80	2,593,063
1895 ...	364,543	59,617	4d.	32,753	249,747	20s.	40,347	27,090	123,630	4·56	2,060,317
1896 ...	863,469	179,956	4d.	32,996	370,839	20s.	50,984	35,831	601,254	16·78	3,048,531

* From the Statistics of Queensland.

Department of Agriculture,
Brisbane, Queensland, 5th October, 1897.

SUGAR.

STATISTICS for the year ended 31st December, 1896, show:—

					Tons	cwt.	qrs.	lb.
Sugar imported and entered for home consumption					49	5	3	22
Manufactured in Queensland					100,774	0	0	0
Total					100,823	5	3	22
Sugar exported—	Tons	cwt.	qrs.	lb.				
White	17,371	18	2	0				
Yellow	2,848	15	0	14				
Ration	55,154	9	3	0				
Deduct exports					75,375	3	1	14
Balance for home consumption					25,448	2	2	8

The estimated population at the close of 1896 being 472,179 persons, the consumption per head of population therefore equals 120·724 lb.

The Markets.

AVERAGE PRICES FOR SEPTEMBER.

Article.		SEPTEMBER. Top Prices.
		£ s. d.
Bacon	lb.	0 0 6¼
Bran	ton	3 11 3
Butter, First	lb.	0 1 4⅛
Butter, Second	„	0 0 10¾
Chaff, Mixed	ton	4 2 6
Chaff, Oaten	„	5 5 0
Chaff, Lucerne	„	3 18 9
Chaff, Wheaten	„	3 7 6
Cheese	lb.	0 0 6⅜
Flour	ton	14 0 0
Hay, Oaten	„	4 15 0
Hay, Lucerne	„	2 18 9
Honey	lb.	0 0 2
Japan Rice, Bond	ton	13 10 0
Maize	bus.	0 2 1¼
Oats	„	0 3 10½
Pollard	ton	3 12 6
Potatoes	„	6 0 0
Potatoes, Sweet	„	1 18 9
Pumpkins	„	3 0 0
Sugar, White	„	15 10 0
Sugar, Yellow	„	13 10 0
Sugar, Ration	„	11 12 6
Wheat	bus.	0 5 4½
Onions	cwt.	0 13 4
Hams	lb.	0 0 8
Eggs	doz.	0 0 5
Fowls	pair	0 3 5¼
Geese	„	0 5 9¾
Ducks, English	„	0 3 5¼
Ducks, Muscovy	„	0 4 1¼
Turkeys, Hens	„	0 6 0¾
Turkeys, Gobblers	„	0 11 3

Farm and Garden Notes for November.

The operations, as far as growing crops are concerned, will consist mainly of keeping the ground loose and clean. In many districts the early wheat harvest will have begun. The crop should be cut when thoroughly mature, but before it is quite ripe, as this will insure a better coloured grain, and loss by scattering will be avoided. The same applies as to cutting oats for hay. When the crop is well in ear, but not mature, the plant is in its most nourishing state. Tobacco plants now require constant watching to prevent the ravages of caterpillars. The plants should be topped back, so that the full strength may be directed into the leaves destined for the crop. Sow imphee, setaria or panicum, teosinte, sorghum, maize, Kaffir corn, and, generally, sow and plant as directed last month.

Kitchen Garden.—The benefit of well-trenched ground will become more apparent as the season advances. Shallow-worked land will not repay labour expended on it, unless it is well mulched with manure, &c. In sowing and transplanting during the summer months allow plenty of room, or the crops will be drawn and worthless. Good, deep, and constant cultivation will always pay in the kitchen garden. Keep the ground clean and open with the digging-fork and hoe. Thin out melon and cucumber plants, and loosen the earth round them. It is a good plan, and will save much of the crop if the branches are pegged down as they extend. This will prevent them being destroyed by high winds, and by so doing they will take root, and therefore ease the main root. Tomatoes should be treated as recommended in Part 4 of the *Journal.* Sow cabbage, French beans, melons, lettuce, radish, pumpkins, cucumbers, rosellas, &c. Transplant for succession in calm cloudy weather.

Flower Garden.—In many gardens dahlias are well above ground, and should be staked. Bulbs which were put away in a moist spot may now be planted out. Reserve the weaker bulbs for later planting, so as to ensure flowers for autumn. Bulbs that have done flowering should be taken up and stored for the season in a dry place. The flower garden should now be in full bloom, and will well repay the trouble bestowed on it, and a little fertiliser of any description given as a top-dressing will assist the plants to bloom and look well for a longer period than with ordinary treatment.

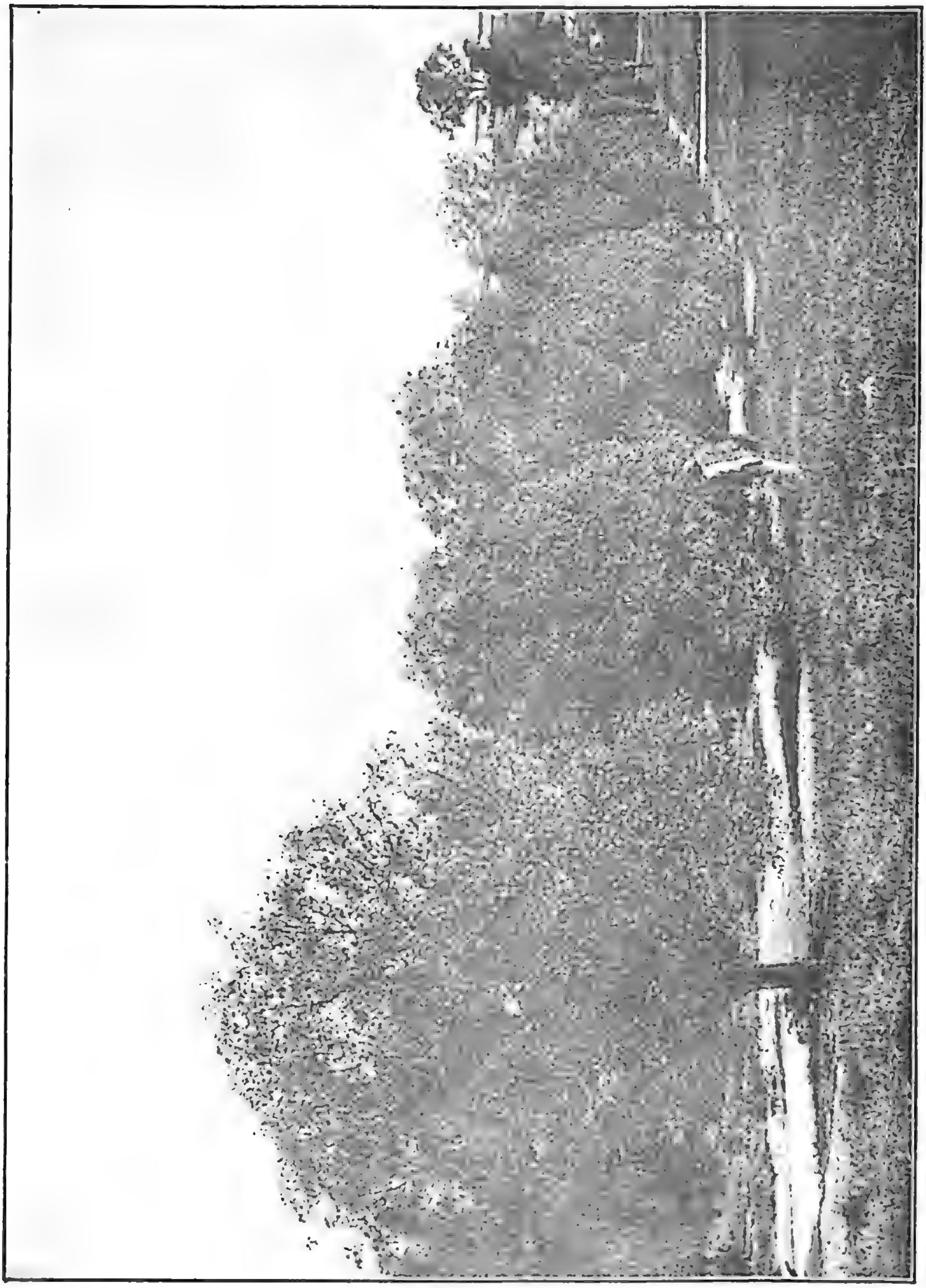
Orchard Notes for November.

By ALBERT H. BENSON.

NOVEMBER is an important month for the fruitgrowers of Southern Queensland, as during it many of the earlier varieties of deciduous fruits—such as cherries in the Stanthorpe district; early peaches, plums, Japanese plums, apricots, apples, and pears on the Downs; and peaches, apples, and early varieties of Japanese and American plums in the coastal districts—will be ready for marketing. Too great care cannot be exercised in carefully examining all early fruits for traces of fruit fly, as the chance of successfully fighting this great pest depends mainly on a thorough and systematic destruction of the first crop of flies. All infested fruit must be gathered and destroyed either by boiling or burying at least 18 inches deep. Every fruitgrower should make it his business to see that his orchard is kept free from this pest, and not only his own orchard but that his neighbours keep their trees free as well. All useless trees, such as inferior seedling peaches, guavas, &c., growing by hedge or fence sides, should be destroyed, as the fruit is valueless, and only becomes a harbour and breeding-ground for the fly. Unless fruitgrowers take action—combined and systematic action—to deal with this pest, it will never be kept in check; and for such action to be effective, it is best to destroy all trees that produce unsaleable fruit, and to concentrate one's energies in keeping such trees clean that produce fruit of such a quality that it will command a ready sale. The marketing of fruit is a matter also that requires much more care and attention than is usually bestowed upon it. In many instances really good fruit is completely spoilt by carelessness in gathering, handling, and marketing, and is consequently valueless; whereas had it been carefully gathered' properly graded for size and ripeness, and packed in such a manner that it will carry well without bruising, and when opened up show to best advantage, it would have realised a satisfactory price. First-class fruit always pays to be well handled and well packed, as for such fruit there is always a good demand; but for badly handled, undersized, and bruised fruit there is little if any demand—at any rate, at remunerative prices. First-class early peaches, such as the Alexander or Brigg's Red May grown on the Downs, would pay to be carefully wrapped in tissue-paper and packed in trays holding one layer of fruit, as, if marketed in such a manner, they could be placed on the Brisbane market in first-class condition, and would realise good prices. First-class apricots, such as the Moorpack, would also pay to be handled in the same manner. Fruitgrowers should bear in mind that the better condition in which they market their fruit, and the more attractively it is got up, the better the chance of its realising a satisfactory price.

During the month, the Orchard should be kept well cultivated, especially in districts where the rainfall is light; and in such districts, if water is available for irrigation, a good watering should be given to all fruit trees and vines. By a good watering I don't mean damping the surface, but giving the soil a thorough soaking, as one good watering is worth a dozen small ones. Attend to the summer pruning of all young trees, removing any superfluous branches and pinching back all strong growths. Attend to the cultivation of the nursery; stake all grafts or buds, so as to produce straight well-grown trees, the bud or graft being topped at the height that it is wished to form the head of the future tree.

Keep the Vineyard well cultivated; disbud and top vines where necessary. Keep a careful lookout for caterpillars or grasshoppers, using Paris green as a spray as soon as they make their appearance; and also see that oidium is kept in check by the use of the sulphur bellows.



GROUP OF CAMPHOR LAURELS (*CINNAMOMUM CAMPHORA*).

Registered at the General Post Office as a Newspaper.]

THE

QUEENSLAND AGRICULTURAL JOURNAL,

ISSUED BY DIRECTION OF

THE HON. A. J. THYNNE, M.L.C.,

SECRETARY FOR AGRICULTURE.

VOL. I. PART 6.

DECEMBER, 1897.

By Authority:

BRISBANE: EDMUND GREGORY, GOVERNMENT PRINTER.

1897.

CONTENTS.

CONTENTS.

Amongst the Warwick Farmers.

To travel through the wheat districts of the Darling Downs at this season, is to become practically acquainted with the magnificent resources of this justly celebrated portion of the many fertile districts of Queensland. It is a revelation which cannot fail to impress the most unimpressionable. Practical farmers from the old country, as well as of the southern colonies, who have had an opportunity to visit the Downs during the present harvest season, are all unanimous in their expressions of admiration of the illimitable fertile plains, and of the excellent methods of farming adopted by the wheat-growers. People who write books on Australia invariably picture the agricultural settler as toiling from year's end to year's end in "subduing the wilderness," in felling and burning giant trees, and in toilsomely clearing the land of innumerable stumps. Here, on the Downs, there is no wilderness to subdue (except, of course, in the case of scrub lands). For miles, there stretch in all directions apparently endless fertile plains of black or red volcanic soil, covered with a wealth of succulent grasses and herbs, whilst at the same time there are, in many localities, areas of timber sufficient for all the settlers' requirements in the shape of fencing, house and yard building, &c. For the most part, however, the new settler has nothing to do but to enclose his land, and put in the plough at once—there is no clearing to be done. Even before the land is reduced to anything like a fine tilth, he may sow a crop of maize or of wheat, and with a fair season feel tolerably assured of reaping a bountiful harvest. There was a time when it was a part of the squatter's creed that cultivation of these lands was madness. Indeed, a squatter, many years ago, said to the writer, whilst showing him one of his splendid stations, between Toowoomba and Warwick: "Look here, sir, I will give 200 acres of that land to any farmer who likes to try it. I will fence it for him, and supply him with horses, implements, and seed. In two years, sir, that man will come to me and say: 'I give it up Mr. ——. It's no use trying to farm on the Downs. The land won't grow a cabbage.'"

Let us take a run through these lands which forty years ago would not give a farmer a bare living, and as a sample we will take the Warwick district, in which are situated those celebrated stations, Canning Downs, Glengallan, Maryvale, Clifton, Goomburra, Toolburra, &c., &c. Over thirty-six years ago agricultural settlement began to progress rapidly here, and to-day large areas of the surrounding sheep stations have been devoted entirely to agriculture. Many of the former managers of the stations are settled in comfortable homes surrounded by their broad well-tilled acres. They raise what a South Australian wheat-grower would consider fabulous crops of wheat, they raise sheep and cattle, and they also raise a splendid race of stalwart sons and daughters who, when the old people sleep with their fathers, will continue to add to the prosperity of the colony, following in their fathers' footsteps and steadily building up the Australian nation. From Warwick a short ride of four miles through a succession of waving wheat-fields, brings the visitor to the Hermitage, one of the Government Experiment Farms, managed by Mr. C. Ross. This property consists of 240 acres, of which nearly 200 have been brought into an excellent state of cultivation in less than five months. Besides crops of wheat, barley, and oats, a large orchard and vineyard have been planted, whilst experimental plots have been sown and planted with a variety of seeds and plants imported by the Department of Agriculture, which on their proved success will hereafter be distributed to farmers on application.

The value of these experiment farms to the settler must soon be apparent. Farmers cannot afford to waste time and money in making experiments. The Government farm will do this for them. If failures occur in any particular product, the farmer can profit by that failure and avoid mistakes. Thus it is clear, that although a Government farm may be expensive and never self-supporting, still the saving of time, labour, and money to the farmers in the district will far more than counterbalance any expenditure by the Agricultural Department in this direction.

Taking advantage of Mr. Ross's knowledge of the district, we drive to Swan Creek, one of the "show" farming districts of Warwick. It would be quite beyond the limits of this paper to mention all the farms visited; and when nearly all are equally systematically and carefully cultivated, it would obviously be unjust to criticise. We will therefore take one or two farms as examples, and say with the classical men, "*E uno disce omnes*"—Judge all by one.

Under the guidance of Mr. Ross, we visited the farm of Mr. George Free, cousin of Mr. Addison Free, a name known all over the Downs wheat districts and even far beyond as that of men whose success as wheat-growers has ever been proverbial. Here the work of harvesting was being pushed forward at full pressure. The golden crop was falling at the rate of from 10 to 16 acres per day before that marvellous creation of man's inventive genius—the reaper and binder. Following the machine come the busy "stookers," and just here we may state that we saw the "stooks" capped. Six sheaves being placed in the stook, two other sheaves were laid lengthwise on top, and arranged so as completely to protect the bottom sheaves in the event of rain. The rust was almost everywhere in evidence, horses, men, and machine taking on a golden russet hue. On asking about the effects of the rust on the crop, Mr. Free was quite unconcerned about it. No doubt the rust affected the crops—some fields worse than others, but, taken on the whole, he considered there would be a fair average yield. Asked to give some idea of the probable yield, he said it was impossible to do so until the wheat was finally bagged. It might possibly average 15 bushels, but, again, some fields would certainly give from eight to ten bags, and others again only two, so that any statement could only be misleading. A nice field of wheat, although rather thin, Mr. Free said was growing on land which had been cropped for thirty years without manure, but this year he proposed to let it lie fallow. Here also we saw a nice little orchard and vineyard, whilst the rick yard was typical of those we remember in the old country. Leaving Mr. Free's, we passed several well-cultivated farms, waving with ripe wheat and young maize. Here and there a few fields were being cut for burning, the rust, combined with want of rain as the heads were filling, having destroyed all hope of even halt a crop. In one instance an apparently fine field of evenly grown wheat, covering 150 acres, was being mown preparatory to being burnt. We remarked to one farmer that it was a pity to see such a loss as he was sustaining, but he, like many others, was not at all desponding about it. The plough would go to work at once, and a crop of maize would take the place of the wheat. The loss was more apparent than real. Men of this stamp are not easily daunted by losses.

At Mr. Cutmore's farm, we found the state of affairs to be as hopeful as elsewhere in the district—the wheat looking well, although somewhat rusty. The anticipated average yield here was stated at from 15 to 20 bushels per acre, but it was also stated that this was mere guesswork, and was not to be looked upon as a certainty. Mr. Cutmore pointed out a field on which the crop was still perfectly green and the grain in the milk stage. Alongside this was another field quite ready for cutting. Both these fields were sown at the same time. It seemed incredible, but such was the fact. The immature field was sown with an American variety, and of course is too late to be fit for anything, unless at once cut for hay. Some 143 acres will be reaped on this farm with apparently very fair results.

Leaving this hospitable abode, we drove to Yangan. On all sides were waving fields of grain, nearly all attacked by rust, but very few being completely destroyed. On Mr. Brewer's farm some was being mown for burning, as also on a few others. Mr. J. Deveney expects to average 12 bushels per acre; and other farmers—Mr. Marriage, Mr. M. G. Free, Mr. W. Lamb, Mr. J. Kemp, and others—at Little Denmark are all likely to make fair average returns. Returning to Warwick by a different route, the cultivated country was seen to perfection, and everywhere the farmers were anything but despondent, notwithstanding the loss of a field or two. It is, of course, an immense advantage to our Downs men that there is ample time to get in a crop of maize, which yields such splendid crops in the district. Here and there might be seen the firestick on one side of a field, the mower in the centre, and the plough at the farther side. The pluck and energy of the farmers are deserving of success, and, however pessimists may talk about the sorrows of the farmers, they themselves are the last to complain—to a man they are cheerful and hopeful.

An early start next morning took us to Mr. Peter Mathieson's scrub farm, about four miles from Warwick. This property is being laid out with a view to the fruit-drying industry—especially prunes. Some 500 trees have been planted. They were obtained from Melbourne, and every tree struck. They will most of them bear next season, and in view of this Mr. Mathieson has purchased a fruit-drying apparatus, which is on its way to the colony. This experiment will undoubtedly be most interesting to fruit-growers, and may lead to the establishment of an industry which has attained such large proportions in the United States. Besides prunes, there are a quantity of apple, pear, plum, peach, quince, and other trees, and a vineyard has also been started. The Xante currants do not promise to be a success. As for vegetables, the soil is admirably adapted for them, the cabbages and cauliflowers being quite equal to those growing at the Agricultural College. Some twenty acres additional are now being prepared for planting prunes.

FREESTONE CREEK.

We now were invited by Mr. Hagenbach, chairman of the Glengallan Divisional Board, to make a trip through the Freestone Creek district, as far as Mount Sturt. This is also one of the show districts around Warwick. Right from the start the traveller finds himself in the midst of grand wheat-fields; and where the land is not yet under crop, it is being rapidly cleared, ready for next season. The soil all through is of the best, and its fertility is evidenced by the magnificent crops now arrived at maturity. In spite of the urgent want of rain, the young maize looks healthy; full crops, dark-green as indigo, testify to the careful cultivation and the good natural drainage, for of artificial drainage there is none. The distance between Warwick and Mount Sturt along the south side of Freestone Creek is about eighteen miles, and almost the whole of this is under cultivation of some kind or other, mainly wheat. The country has the appearance of a vast fertile valley with a breadth of several miles. Travelling along an excellent road we arrive at Blink Bonnie, the residence and farm of Mr. James McIntosh, one of the oldest farmers in the district, and decidedly amongst the most hospitable, although the latter virtue appears to be universally cultivated throughout the district. Mr. McIntosh was formerly a manager of Glengallan sheep station, and has been ever since a most successful farmer. We had a long conversation with him on various topics of interest connected with farming, and with respect to the rust he said that the whole thing lay in a nutshell. Sow late, and you are almost certain to get the rust. Sow early, and you are almost equally sure of escaping it. Had there been rain when the grain was filling, there would have been no failures. As to the probable yield this season, like all other farmers, he would not commit himself to any statement, as the various fields were too unequal to admit of any calculation being made. Possibly the average throughout the district might be 15 or 17 bushels. In estimating the

yield, some think that the area cut for hay and that burnt off should not be included with that cut for grain. If the actual grain-producing acreage were averaged the results would be far more correct, and would give a better idea of the value of the wheat industry. As one man put it: "Suppose I have 50 acres of sugar-cane; 25 acres are burnt accidentally. On the remaining 25 acres I get 30 tons per acre; it is manifestly incorrect to say that my land will only produce an average of 15 tons per acre, for the 25 acres burnt are actually not considered in my returns. And so with wheat. A man burns 100 acres, and from the other 100 he reaps 8 bags per acre. It cannot be said that his land will only yield 4 bags. The method of obtaining the average yield at present, they say, should be altered, as it leads strangers to believe that the land will only produce so much per acre, whether the season be good or bad.

Whilst looking over Mr. McIntosh's garden, he said that last year he escaped the fruit-fly with Brigg's Mayfair peach, which he obtained from the Hermitage. The fruit crop was perfect. This season, although the fruit-fly was much in evidence about blossoming time, yet the pest has wholly disappeared, and all the fruit in the garden looks healthy. It is, however, quite possible that before it is ripe the dreaded visitor or one of its congeners may again put in an appearance.

Once more on the road, and we drive through thriving farms till we reach the scrub farms at Mount Sturt. There is little to indicate to the uninitiated that the smiling fields he sees around him were not long since covered with dense scrub. That has all disappeared, not a stump remaining to tell the tale. Paling fences, however, at once suggest the wallaby, and the wallaby haunts the scrubs. Here there is more maize and potatoes than on the plain land, but large areas are also under wheat, and everywhere the reaper and binder is at work. The country is covered with countless stooks of sheaves, and stacking is beginning. Some farmers intend leaving the grain in the stook and thrashing before stacking. This would hardly seem a wise proceeding, for if rain should come on it might happen that the thrashing machine and its attendants would have to be kept on the farm for a couple of extra weeks—a matter then of diminished profits.

Everywhere there appeared a spirit of content with the prospects. Farmers, like John Bull, are said to be privileged grumblers, but no grumbling was heard here, except in some cases where it was stated that machines were late in arriving. It must certainly strike our southern farmer visitors that wheat farming in Queensland is a solid industry, and that the lands repurchased by the Government, and sold on exceptionally easy terms to intending farmers, cannot be excelled by any in any other part of Australia. It is anticipated that when the Headington Hill land is thrown open early next year, there will scarcely be an acre of it which will not be taken up. At Mr. King's farm, on Upper Freestone Creek, we found harvesting in full swing, and the same on Mr. Martin Burke's property. Continuing the round, we drove past the Upper Freestone State school, past the Glebe, and on down the north side of the creek, where we called at Mr. P. Cavavan's home. In all directions here could be seen field after field waving with its golden crop, whilst in other parts of the farm the grain was everywhere cut and stooked. Prosperity was writ large on all sides. Following on the road to the intersection of the Maryvale road, town was reached about 7 p.m. We had travelled over nearly forty miles of country, and yet had seen but a fraction of the agricultural wealth of the district.

At Killarney the same thing is to be seen—wheat everywhere; but the reaping had barely commenced here.

A quantity of wheat is being cut for half a crop, but some are hurrying up to get off the rusted crop to plough for maize. Mr. Wilson, of Freestone Creek, had turned a flock of sheep into a 120-acre field; whilst Messrs. Brewer, C. Lewis, and J. Shelley were burning off larger or smaller areas.

The Allora Spring Wheat resists the rust better than any other variety except Budd's Early. Mr. Hagenbach sowed some of this variety, which he obtained from the Agricultural Department. It was sown late in July, and is now ripe without a sign of rust. Professor Shelton, of the Agricultural College, says that this is a most valuable variety, and those who have it should retain as much as possible for seed. Mixed with Allora Spring, it makes a splendid milling sample. Mr. Hagenbach estimates the yield at from 25 to 30 bushels per acre.

Many farmers intend sowing considerable areas of barley next season. The crop on this occasion will turn out very good, but the area under barley is small. Taking a general view of the wheat harvest, it would appear that, although the bright anticipations of the early part of the season are not likely to be realised, still there will be a large quantity of grain of excellent quality in the farmers' hands. In addition to this, the maize crop will, if seasonable rains fall, be a very large one. The outlook, therefore, is a hopeful one, and next season will see a still greater area under both crops.

Another Paying Crop for Queensland.

THE TOMATO.

By HENRY A. TARDENT,
Manager of the Westbrook Experiment Farm.

One of the great charms of life in these Australian Colonies is that here the poorest of men, the humblest tillers of the soil—provided they are gifted with some activity, industry, and taste—can indulge in the enjoyment of the most exquisite flowers and fruits, such as are in the old country available only to lords and wealthy capitalists provided with hothouses and other artificial heat-producing appliances. The enumeration of those grown in Queensland alone would include the whole flora of tropical and sub-tropical countries, supplemented by all the products of temperate Europe. Among the new products met here, on landing, by the immigrant from Great Britain and Northern Europe, none perhaps meet with such a universal appreciation as the tomato or love-apple (*Lycopersicum esculentum*). If some do not take to it at once as a fruit, I know of nobody who does not like it as a vegetable or condiment. It is relished under the form of jams, jellies, chutneys, pickles, sauces, and salads; it is also excellent when stewed, fried, canned, stuffed with rice and minced meat. It improves every dish to which it is added, such as soups, stews, gravies, &c. It can also be dried in small tablets, and be thus preserved for any length of time in a very contracted form.

Such a general appreciation is due no doubt greatly to its agreeable, sweet, and subacid flavour, but also to its refreshing and beneficial effect on the whole human body. It stimulates digestion, and facilitates the functions of the kidneys and liver, thus counteracting the ill-effects of the excess of meat diet in which we too often indulge in these colonies.

The tomato has also the great advantage of being of easy cultivation. The plant, being a native of inter-tropical America (Mexico and Peru), feels, so to say, at home in the whole of Queensland. In the north and on the east coast it grows nearly without care all the year round. It is necessary, however, to train it on stakes, rails, or trellis, for in all countries where wet seasons predominate, such a method has considerable advantages, which are thus summarised by Mr. J. W. Kirk, the learned and genial Biologist of New Zealand:—(1.) It lets in sunlight and air, thus checking most diseases. (2.) By raising the vine (as the stem is called) from the ground, it renders the fruit less liable to the attacks of caterpillars, &c. (3.) It greatly facilitates spraying, pruning, and gathering.

Although such a method is recommended by all writers on the subject, and regularly reproduced every season by most of our agricultural journals, it is, I am sorry to say, no good for the districts situated west of the range, which comprise over two-thirds of the colony.

There are there, peculiarities of seasons and rainfall which require a different method of culture altogether.

First of all, the West is subject to occasional late frosts (we had a rather severe one as late as the 12th October at the Experiment Farm), and the tomato is extremely sensitive to cold. These two circumstances make it indispensable to raise the seedlings in hot-beds. I have recently explained (see *Queensland Agricultural Journal*, No. 1) how to make a manure hot-bed. In cheaper than manure. In that case, one can make, quite cheaply too, a the bush it sometimes occurs; however, that firewood is more plentiful and permanent hot-bed with furnaces and flues, such as we have now at the Experiment

Farm. Where there is a soil with a declivity of at least 2 feet in 50, it it suffices to dig in it two parallel flues, 2 feet apart, about 18 inches square at the bottom end, and say 8 inches square at the top end. Build at the bottom end a furnace 4 or 5 feet long with fire-bricks (it will take from 300 to 350 bricks). Then continue the flues either with curved tiles or even stone flags; then build round them a frame 40 or 50 feet long by 5 or 6 feet wide, for which purpose you can use either ordinary bricks or boards. Take care that the slanting part faces the midday sun. Then fill with light loam until the soil is nearly level with the front side of the frame. Where the ground is flat it becomes necessary, of course, to dig in it a ditch 5 × 50 feet, 3 feet deep at the furnace end, and 1 foot deep at the other. Bricks or boards can be used to make the chimneys, which should be 8 × 8 inches, and at least 8 or 10 feet high to ensure a good draught. As glass is rather expensive, a simple canvas is sufficient to cover the bed during the nights and cold days, and it can be rolled up during the warm hours of the day.

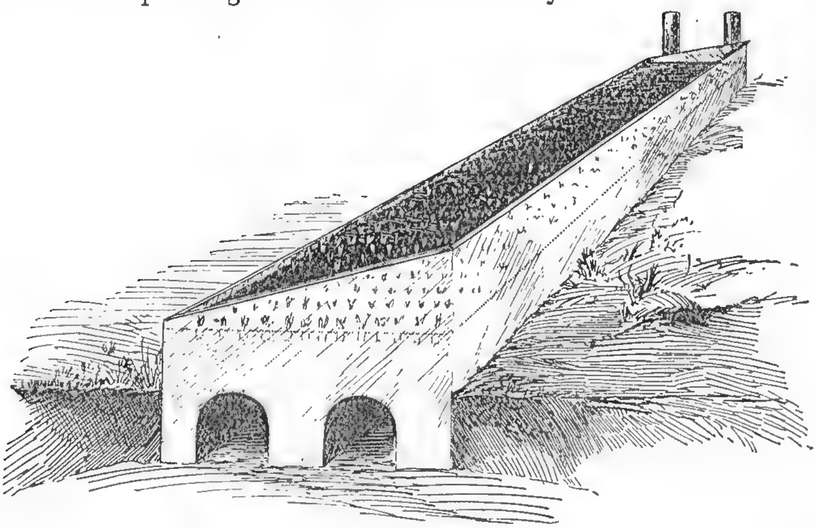


Fig. 1.

Secondly, the tomato is rather difficult to transplant successfully, unless a good lump of earth can be retained around the roots. To secure this end, the writer has used for years past a very simple device, which makes transplanting a pleasure and enables him to guarantee 100 per cent. of strikes. Get your tinsmith to cut for you pieces of strong galvanised iron 10 inches × 3, and to bend them cylinder-like on his machine; but without soldering them. If he is reasonable, he will let you have them for 5s. or 6s. per gross. A still simpler way is to take old jam or swiss-milk tins, and to throw them into the fire to melt the soldering, after which they are ready for use. Now put those unsoldered cylinders into your hot-bed (Fig. 1); shake on them through a sieve some rich light loam mixed with well-rotted manure or vegetable mould. When they are filled within half an inch of the top, drop in the middle of each tin *one* tomato seed; then fill up, as explained above, until the soil is nearly level with the tops of the tins, and give a moderate sprinkling with lukewarm water. If you now make, during the days only, a moderate fire in your furnaces, the temperature in your hot-bed will vary between 50 degrees towards the morning up to about 80 degrees in the middle of the day, and the plants will shoot up in from three to five days. Husband well the moisture in the soil, but water very sparingly. Too much water makes the plants lanky and weak. In from four to six weeks they will be ready for transplanting.

A perfect tomato soil should be a deeply ploughed and subsoiled sandy loam, well pulverised, and naturally or artificially well drained. The tomato being a gross feeder, the soil in which to grow it can hardly be too rich,

especially in lime, potash, and sulphuric acid. Too much ammonia, however, as is contained in fresh cow manure, induces a rank growth of the vine which renders the plant liable to diseases.

When the land is reduced to a tilth as fine as flour, and when all danger of frost is over, then is the time to transplant.

Take now two poles, say 7 feet long, and on them nail a few light boards, say 3 feet long, which will give you a hand-bearer.

Take also a mason trowel with 2 or 3 inches of the pointed end cut off, go to your hot-bed, which has been copiously watered the day before, thrust the trowel under the above-described unsoldered tins, lift gently and deposit on the board of your hand-bearer. When a sufficient number has been lifted for a load, carry to the field; take again the tins one by one on your trowel, and leave one at every intersection of two furrows. Bring the surrounding earth towards it with your hands, then slacken gently the tin and take it off. By that simple manner the tomato plant has retained the whole lump of earth in which it had grown, and hardly feels the effect of transplanting at all.* No transplanting should take place, however, when the soil is cold; in the middle of a hot day, or in windy weather. Should it be rainy or cloudy no watering is required, but if hot and dry a pint of tepid water given to each plant is beneficial.

Should the weather prove very unfavourable, it would be well to protect each plant for two or three days with covering of paper or bark. Should a late frost be feared, the same means would suffice to protect the plants. If the soil is thoroughly pulverised and light, there is a still simpler way of preserving the plants from frost. It consists in walking along the rows and pushing in front the hand-hoe Planet Junior with the two mould-boards turned inside, thus covering every plant with a couple of inches of soil. They will stand it without injury for at least forty-eight hours. The uncovering must be done carefully by hand *towards the evening* of the following day.

During the three or four following weeks, the work consists chiefly in keeping the horse Planet Junior going, first in one direction, then crosswise in another. This will maintain the land perfectly free from weeds, and well tilled. It also reduces the *chipping* by hand round the plants to a mere trifle.

If a few very early tomatoes are required, you can now prune a few plants, pinching off the side-shoots, topping when a few bunches of flowers have appeared, and tying the plants up on stakes or trellis. But in ordinary seasons these plants are sure to die off during the hot scorching days of January. For the main crop—I speak for the districts lying west of the range—do not stake at all, nor train on trellis. Put around each plant a 6-inch layer of long straw which has been previously trampled under the feet of horses in the yard or in the stable, and over this add another 6-inch layer of clean straw. In that way the plant, having its roots well fed and protected, will make rapid headway, will spread on the mulch in every direction, and yield abundantly for eight or ten weeks. At this time, which generally coincides with the beginning of the rainy reason, prune them rather severely, leaving only four main branches. The cut-off branches can be used as cuttings to make new plants from. They come rapidly into bearing. The lover of nature, who has time at his disposal, can also insert them into a potato stem by the process known as herbaceous graft, and indulge in the pleasure of getting two simultaneous crops, one of tomatoes on top and one of potatoes underground. The operation succeeds easily, both plants belonging to the same family (the *Solanea verae*). Lay these down into trenches 6 inches deep, running in four directions at right angles to each other, leaving only 7 or 8 inches of the ends out of the ground. When the operation is finished, the whole field looks again as if it were regularly planted; only the plants occupy now the middle of the squares of the first planting.

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* This method is in effect the same as that adopted by Mr. W. Soutter, Curator of the Acclimatisation Gardens, Brisbane, for transplanting palms from the Blackall Ranges.—Ed. *Q.A.J.*

In three or four weeks these layers will have set new roots, and they will bear again abundantly during April and May. They will still be loaded with fruits when the first frosts appear. If they are protected at night, or if fruits are gathered green and spread on shelves, or, again, if the whole plant is uprooted with its fruit on and hung in a shed, the tomatoes will ripen gradually for a couple of months longer, well into the winter.

By following that plan, you can defy the severest droughts, and secure for each plant a crop which is positively stupendous. The returns in weight per acre run into such figures that the writer hesitates to formulate them here for fear . . . the printer might be accused of having, by mistake, added a nought to them. It will suffice to say that he knows of only the banana and sweet potato which have any chance of surpassing it.

The results show conclusively that such a method of training the tomato is congenial to its nature.

We must not forget that the tomato is in its native state a plant with rampant habits, as is confirmed by the adventitious roots which—as in the pumpkin—strike at every joint which comes into contact with the ground.

Picking is a rather important operation, which must be performed every day as soon as the plants are in full bearing The picker must be provided with two buckets or baskets. In one he puts all diseased or otherwise injured fruits, which ought never, on any consideration, to be left lying on the ground; in the other he gently places all sound fruits, taking care not to shake the plant too much. For home consumption, for a near market, or for the jam factory the fruit should be gathered thoroughly ripe; for sending any distance away, they are best gathered when they just begin to change colour.

They should then be *carried* gently into a cool shed, where the grading and packing take place. They should never be *poured* from one vessel into another, but taken gently one by one with the hand, and graded thus:—(1) Large ripes, (2) medium ripes), (3) small ripes, (4) large greens, (5) medium greens, (6) small greens, and (7) culls, which should never leave the farm except under the form of eggs or bacon.

Never pack tomatoes—and this applies to other fruits, too—whilst they are warm from the sun's rays. Let them first get cool in a draughty place, under a covered shed.

What Varieties to Grow.—The varieties are now so numerous that one has only, so to say, the trouble of choice. We can lay down as a rule that it is not worth while growing sorts with asperities and creases on their surface, as they are, more than others, liable to harbour pests. We would rather give the preference to all fleshy, firm, and smooth varieties.

The Ignotum, the Acme, the Trophy, the Golden Queen, the Dedham Favourite, and Optimus can hardly be excelled for dessert or general purposes. The Duke of York is rapidly becoming a favourite, too. The King Humbert, though smaller, is both early and late, very hardy, and prolific, so is also the Rival. The little hardy and ornamental Dwarf Champion should have a little corner in every garden. Ponderosa and Crimson Cushion are very showy. The little Golden Pears and Golden Drops, by their pretty shape and colour, do well to relieve others by contrast in the dessert dish, etc.

Diseases and Pest.—When planted on well-drained and easily permeable soil, the tomato is a most hardy plant, requiring in fact very little water for the production of perfect fruits, but on badly drained and cold soils it is—especially in wet seasons—subject to many fungoid diseases. The principal are the Leaf Blight (*Gladosporum fulvum*), which destroys rapidly the whole plant; the Tomato Black Rot (*Macrosporum tomato*), which attacks the fruit before it is ripe round the blossom end; and another fungoid disease, which Dr. Cobb, the eminent Pathologist of New South Wales, calls the Pimple Rot. It resembles much the former disease, except that it attacks also the sides of the fruit. One or two sprayings of Bordeaux mixture given before the plant starts flowering are said to be a good preventive. The writer, however, puts greater faith in good drainage, thorough tillage, the removal and burning of

every diseased fruit and plant, and also in avoiding growing tomatoes for two years in succession on the same ground. It is surmised that the microbes, producing in the fall the decay of the vine, leave in the soil germs which are likely to affect a subsequent crop. In the West those fungoid diseases seldom cause trouble to the careful grower. Our great enemy there is the Attila of the tomato, the fearful *cut worm*, a most nefarious insect which cuts the stem just level with the ground, a few days after transplanting. The only way I know of to put a check to its depredations, is to make iron or card-board hoops 3 inches wide and say 8 or 9 inches in diameter, to dip them in tar, put them round each plant, and press them for an inch into the ground, leaving 2 inches over ground. The pungent smell seems to act as a deterrent to the pest.

Notwithstanding the above drawbacks, few crops are so profitable and so pleasant to grow as the tomato. When the land has been prepared, the remaining work can be nearly all done by the weaker members of the family of either sex, who take pleasure and pride in it. To the new settler, it promises an abundant crop within four months after sowing. Let us hope that the time is not far distant when, in every agricultural centre, there will be not only a co-operative store, but co-operative jam factories and evaporators. Then there will be hardly any farm in Queensland without at least a few acres of the luscious tomato.

The Growing of Malting Barley.

The following hints on harvesting the crop of malting barley we take from the *Warwick Examiner and Times*. Mr. Redwood's remarks will prove useful to those farmers who propose next season to devote attention to this crop:—

HINTS ON HARVESTING THE CROP.

Some months since, Mr. V. C. Redwood, of Toowoomba, read a very interesting paper to the local agricultural society on the subject of growing barley for malting purposes on the Darling Downs. Several farmers in this district have barley crops this season, and the following extracts from the paper should be interesting to them, especially as the crop is on the point of maturing. On the matter of

CUTTING

Mr. Redwood, who is a man of practical experience, and as a maltster, is able to speak with authority, says—The crop may have passed through all its stages of perfection up to the cutting. Barley is not like wheat or oats, which have sufficient nutritive powers in the straw to develop the grain if cut a little on the green side. Barley, on the other hand, must be ripe before it is cut; if cut on the green side, the grain will shrink, consequently it cannot be classed as prime malting, as from its flinty and steely nature it cannot possibly give the extract peculiar from ripe or mellow barley. At the same time it must be borne in mind that to leave the crop standing too long in a ripe state will result in a great loss by the grain shaking out. The principle of cutting barley is this: That as soon as it becomes hard it should be cut immediately, or as soon as possible, as barley over-ripe is almost as bad as being green when cut.

STOOKING.

The barley should be stooked as soon as possible, as a shower of rain would greatly discolour it if left on the ground. Farmers should be very careful to see that it is well stooked.

FIELDING.

This is a feature that should not be neglected, as you can improve a sample of barley in the field. If the season is favourable a fortnight is not too long, as a slight rain and the dew tend in a great measure to mellow it. Of course, during unfavourable seasons the farmer must exercise great care, and on no account allow the grain to be stacked until thoroughly dry. The fact of its being slightly discoloured under these circumstances will not affect the quality of the barley.

STACKING.

This is a point that requires great care, more so than in any of the other white crops. Even in the best of seasons and in bad years it is often found very difficult to save it. It should never be carted unless it is perfectly dry, otherwise it is in danger of being heated in the stack or becoming mow-burnt, which makes it absolutely useless to the maltster, for the undue action of the heat destroys the germinating power of the grain, which consequently will not malt. It will be prudent therefore not to stack barley until the heat of the sun has evaporated the dew. For about one month in the stack a certain degree of fermentation or sweating is created which assists to sweeten or mellow the grain, and barley should never be thrashed until it has remained in the stack at least six weeks or two months. In building a stack the proper way is to build from the middle of your centre or square in the form of a

stook, and layer the sheaves round it until you have left two or three feet round the sides to start your outside ring, and so on, always taking care to keep the middle of your stack well filled. This is most important, as it prevents the rain penetrating. The stack should be thatched as soon as finished.

THATCHING.

The majority of farmers are of the opinion that thatching is not necessary; this is a great mistake, as it costs little, and then you know your crop is safe from all weather. The best thatch to use is rushes, but they are very difficult to get in Queensland, whereas wheat straw or reeds make a good thatch and are easily procurable.

THRASHING.

One may have a perfect sample of grain, and then have it fatally injured in the thrashing. The revolutions of the drum should be at least 200 less than that required for thrashing wheat, and the concave of the machine must not be set too close to the drum, or it will break and bruise the skin of the barley, and nip the awn off too close, which renders the grain practically useless for malting purposes, and, no matter how perfect the grain is, mould must develop during the germinating process. To avert this, in thrashing far better leave a few awns on the barley, which is not detrimental to the grain in the slightest degree. If the barley is found to be smutty, do not put it through the "polisher," but through the "screw," as then the smut bladders are not broken, and the grain does not get a discoloured tip that it would otherwise. Still there should be no smut at all if the pickling is properly attended to. Be sure and open the screen in the thrashing machine, and take out both seconds and thirds in order to secure an even sample. It must be borne in mind, if this is not done the inferior grain has to be taken out at the malt-house, and in purchasing barley the maltster always takes this into consideration. Taking Mr. J. G. Sims' figures for last season's barley, they show that there was a loss of about one-fourth through this cause. I was maltster for Mr. Sims, and can fully bear out his figures, which were published a few months ago.

Ploughing-under Green Crops.

In the October number of the *Journal*, we reproduced an article on the above subject, together with a diagram of plough and chain attached, from the *Agricultural Journal* of the Cape of Good Hope. This has much interested many of our farmers. A suggestion by Mr. Samuel Grimes, M.L A., Brisbane, who is quite conversant with the advantages of using such a chain, having used it for the last twenty years, says that the end of the chain, instead of being fixed to the end of the beam of the plough (as in the diagram alluded to), should be attached to the end of the double swingle-tree, and the loop not be allowed to go farther back than the middle of the mould-board, so as to be clear of the furrow in falling over.

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Canaigre.

(*RUMEX HYMENOSEPALUS*, Torr.)

A so-called "new" tanning agent is Canaigre. It has been known, however, for its tanning properties for the last twenty-five years in Europe and the United States, whilst it has been used by the Mexicans in tanning for two hundred years. There, it is called "Yerba Colorado."

The *Bulletin of the Royal Gardens,* Kew, No. 125, 1897, gives the following extract from the Report for 1896 on the Trade and Agriculture of California (Foreign Office, 1897):—

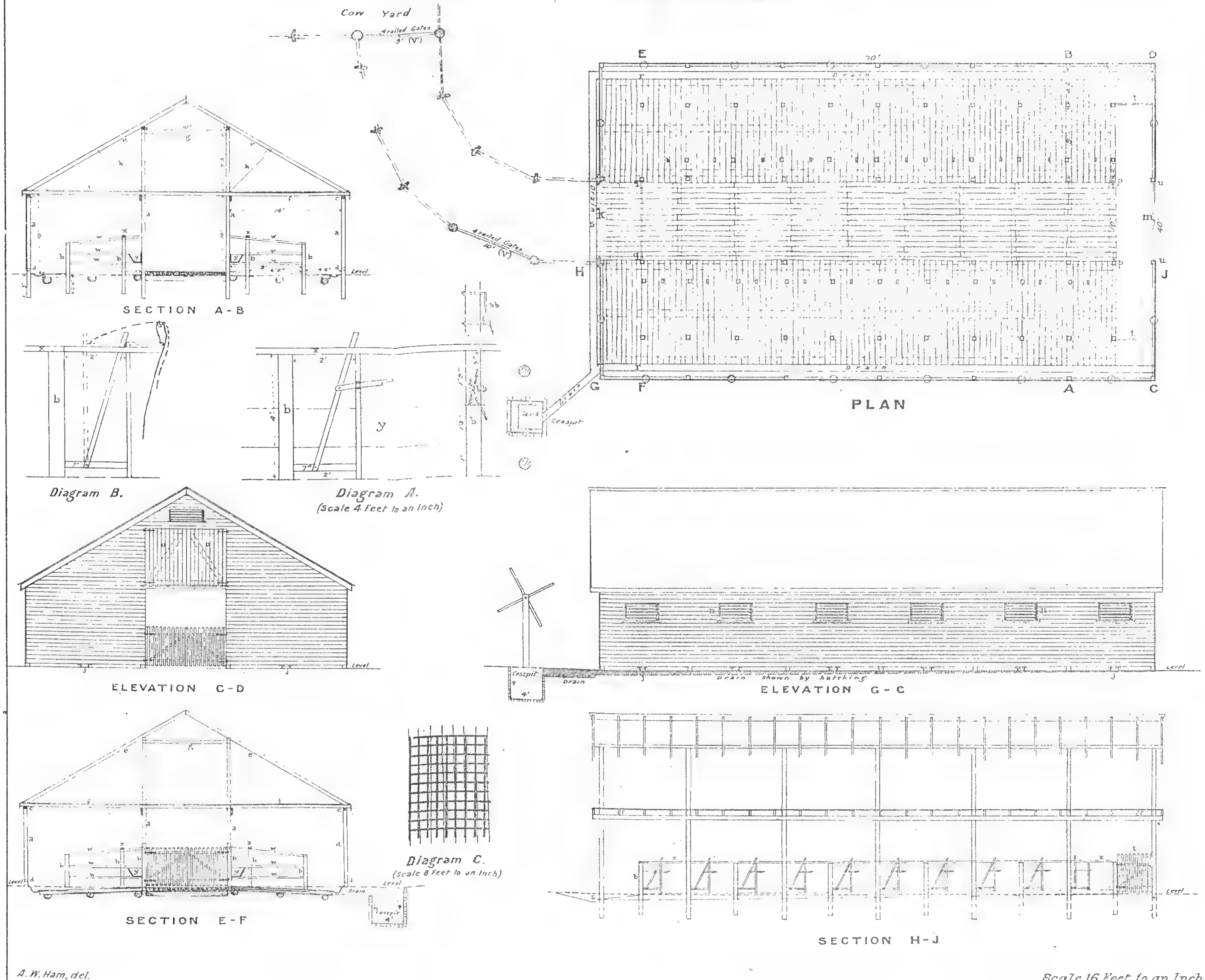
The name Canaigre is said to be the American corruption of the Spanish "cana agris"—sour cane. It is also locally known as "red dock," "tanner's dock," and "wild rhubarb." The best way to propagate the plant is by the use of small roots rather than by seed. About 1,000 lb. of tubers will plant one acre, and the planting may be done at any time with irrigation.

The value of Canaigre as a tanning agent, either alone or in conjunction with other tannins, has been proved beyond question. For light leather, it gives great textile strength, and is far better for split leather than gambier, oak, or hemlock. It is a quick tanner, and the yellow colour absorbed by the hide in the process of tanning is considered highly desirable for certain leathers. The sliced and dried tubers, containing an average of 30 per cent. of tannic acid, are worth from £8 to £9 per ton. The yield of from 7 to 10 tons per acre would give 2½ to 3½ tons of the dried product, for which there is a constant demand in Europe and America. Inasmuch as the plant grows wild in this vicinity (in California), and the seeds and roots are readily obtained, the industry commends itself to the farmer of small means, as it is harvested in such a short time from planting.

Canaigre roots consist of clusters resembling sweet potatoes, and they are found near the surface, and sometimes on the top of the ground. They are rapidly dried, and at a certain stage are cut into small pieces. Outside, the roots are of a dark-reddish brown colour, becoming by age almost black. Interiorly, they are from a bright to a brownish-yellow, according to age and to amount of exposure. It is said that the dried and ground root can be delivered in any part of the United States at a price not exceeding 3 cents per lb. (£42 per ton). Some authorities give the yield at from 15 to 20 tons per acre.

Canaigre would seem by the above report to be worth while planting, even if the low return of 3 tons of dried roots be obtained, and sold at £7 per ton. The plant thrives in Queensland, and has been successfully grown at the Government nurseries and experiment farms.

PLAN OF COW-SHED



A Model Cow-shed.

MR. J. MAHON, Government Dairy Expert, forwards plans and specifications for a dairy-shed, which he has for some time past been engaged in perfecting. His intimate knowledge of the requirements of dairymen in the matter of housing, &c., should commend the scheme here shown to all interested in the dairying industry.

SPECIFICATIONS FOR BUILDING COW-SHED.

The shed to be 70 feet long and 40 feet wide.

Standards (*a*) and posts (*b*) to be 6 in. × 6 in. hardwood

Top plates (*c*) to be 6 in. × 4 in. hardwood.

Bottom plates (*d*) to be 4 in. × 4 in. hardwood.

Studs to be 4 in. × 2 in. hardwood, 18 in. apart, tenoned into top and bottom plates.

Rafters (*e*) to be 7 in. × 2½ in. pine.

Joists (*f*), collar ties (*g*), and struts (*h*) to be 7 in. × 2½ in. pine. Supports for joists on standards to be 7 in. × 2½ in. hardwood.

Roof battens to be 3 in. × 1½ in. pine.

Bottom plates to be tenoned into standards and spiked on to capped stumps as shown *j* on plan; stumps to be 6 in. above surface of ground.

All external walls to be of hardwood weatherboards, except opening 10 ft. × 10 ft. shown on plan at *k*, which is to be left open, and opposite end of shed (*m*), where gate is to be placed.

Shutters, 4 ft. × 2 ft., to work on pivot, to be placed on each side of building as shown on plan *n*, with ordinary hardwood sills tenoned into studs.

Floor of hayloft to be of 6 in. × 1 in. T. and G. pine, to be nailed to top of joists.

Trap-door, 6 ft. × 5 ft., to be made just inside receiving door of loft.

Doors of hayloft to open outwards, and built as shown on plan *o*.

Roof to be of galvanised iron.

Flooring of shed to be of hardwood rough timber, not less than 6 in. in diameter when dressed—to be dressed on three sides and fitted together, resting upon bearing logs of not less than 10 in. diameter, as shown on plan.

Surface of floor to be raised 6 in. at *p*, sloping to level of ground at commencement of drains; the drains to be 10 in. wide by 4 in. deep in centre and faced with cement. Drains to have a fall of about 1 in 100. The floor also to have similar fall lengthways, as well as to drains, which will cause the surface of floor at *q* to be about level with the surface of ground, and at *r* to be 9 in. lower than the surface. Centre-way of shed to be floored in similar manner to sides, but slope towards *q* only. Floor where exposed to traffic, &c., to be checked out 6 in. × 6 in. to a depth of 1 in. by width of 1 in. in checks, as shown by Diagram *C*.

At lower end of building the drain to be formed outside as shown on plan; and where roadway crosses it at *s*, the drain to be dished as shown in section *h*–*j*, to enable cattle and vehicles to cross readily. Drain continuing to cesspit to be also dished and roughly faced with cement for 5 ft. on each side. Cesspit to be square, 4 ft. × 4 ft. × 4, bricked and cemented.

Strong square iron tank, 3 × 3 × 3, to be made for cesspit, with handle hooked to rings riveted to tank.

Gallows to be erected, made from rough timber, 9 ft. high, and posts 12 ft. apart—to be used for lifting tank into dray when necessary.

Small gates, 4 ft. 6 in. wide × 5 ft. high, to be placed at *t t*, opening against rail of cowstalls.

Gates to be hung on standards at *u* and on posts at *q*, as shown on plan. Thus making the centre-way of shed 10 ft. clear in width, available for carts, drays, &c., to be taken through building to cowyard, or through 10-ft. gate at *v*; also enabling the cows to be fed with rapidity and saving of labour; or a light tram line could be carried through the building along the centre-way from hay shed or silo, and cows fed on each side.

Gates outside at *v* and *v* to be 5 ft. high and 10 ft. and 9 ft. wide. Roadway from cowyard to shed to be fenced with 4-rail split fence.

In shed, rails at *w* between pens to be of 3 ft. × 2 in. hardwood tenoned into posts and posts, and posts and standards, respectively.

Bails to be erected as shown on plan and by Diagram *A*, an alternative design of bail shown by Diagram *B*. Another alternative for bail is shown on Diagram *A* at *b b*, to consist of an iron bar bolted at each end through post (*b*), about 1 ft. in length, with a ring to enable a rope or chain to be attached and slide up and down, with the other around the neck of cow; this would dispenes with the bails and allow cow to be tied close for milking or looser for keeping in stalls at night. The top rail (*x*) of bails to be double 3 in. × 2 in. hardwood rabitted on to the bail posts, one on each side, to leave 2 in. space between to admit of bail sliding to and fro—to extend the whole length of the stalls.

Feeding-troughs (*y*) to be 15 in. at back, 12 in. at bottom, and 18 in. in front, to extend the whole length of the stalls. Feeding-trough to be nailed against standards, and rest upon the bottom rail (*w*).

This outline for building cowshed may be too elaborate for the majority of dairymen, but where rough timber is available the main plan of the building could be adhered to, and a shed could be erected at a greatly reduced cost; for instance—

For Standards, rough timber, 7 in. diameter.
„ Posts „ „ 7 in. „
„ Top plates „ „ 7 in. „
„ Rafters and joists, saplings about 5 in. diameter.
„ Supports for joists on standards, rough timber about 7 in. diameter.
„ Roof battens, light saplings.
„ Rails, saplings about 5 in. diameter.
„ Bails, rough timber of slightly larger size than specified.
„ Flooring, stone pitching could be substituted if stone in locality; or sawn blocks of 6 in. diameter, 6 in. long, placed on end could be used.
„ Drains, stone-pitching or half-round hollow logs.
Walls could be made of bark or slabs.
Roof of thatch, bark, palings, or shingles.
Hayloft could be floored with light slabs.
Gates and doors could be made from split timber.

The whole of the work could in this manner be carried out by the aid of this plan and information by any handy man used to carpentering work.

Poultry.

POINTERS IN DUCK CULTURE.

(A Capital Article by Mr. Boyer in *Farm Poultry.*)

The following pointers have been gleaned from interviews, correspondence, and writing of such men as Rankin, Hallock, McFetridge, Campbell, Irish, and others, together with our own experience in duck culture on a small scale, covering a period of nearly ten years. We combine them here in one article, believing that they will be appreciated and of value:—

The *American Cultivator* says the duck has fewer objections than any fowls—it is no scratcher, is not given to flying, is healthy, hardy, has a fine-sized carcass; a strictly home bird. They are easily raised after the first few weeks, during which time they have to be kept from wet until their feathers grow and shed the water, after which they are liable to fewer ailments than chickens.

An experiment carried on some years ago in France, to determine the relative value of hens and ducks as egg-producers, resulted greatly in favour of the ducks. Three birds of each sort were selected for the trial, and between the first day of January and the last day of August the three hens laid 257 eggs, and the three ducks 402 eggs. Moreover, in the autumn of the previous year the ducks had produced 215 eggs after the hens had ceased laying altogether.

The *Rural New Yorker* says, for the table, everyone is willing to admit the duck's excellence, though the want of cleanliness in its habits meets with everybody's reprobation. As a feeder it has few equals, while its feathers in the market stand high above those of the hen or turkey, and only second to those of its giant companion, the goose.

At Hammonton, N.J., an experiment was tried with ducks and chicks by P. H. Jacobs and others, to determine the relative growth of each in a given time. This is the result:—

Compared with chicks, the growth forced on high feeding, with a lot of ten ducklings and chicks for experiment, with the same amount of food for producing 1 lb. of flesh (usually a cost of 5 cents for each 1 lb. of carcass), we present the following:—

	Duckling.		Chick.	
	Lb.	oz.	Lb.	oz.
1 week old ...	0	4	0	2
2 weeks old...	0	9	0	4
3 weeks old ..	1	0	0	6¼
4 weeks old...	1	9	0	10
5 weeks old...	2	2	0	14
6 weeks old...	2	11	1	2½
7 weeks old...	3	5	1	7½
8 weeks old...	4	0	1	12
9 weeks old...	4	8	2	0

As they approach maturity (after the eighth week) the ratio of gain begins to become proportionately less, while some were heavier than others. The ducks were kept in a small coop, and fed to demonstrate the highest point they could be made to attain, the purebred Pekins being used for the experiment.

A duck generally lays as many eggs in a year as a hen, but she performs the work quickly, and rests the remainder of the season. The hen extends her laying throughout the entire year.

General Management.

Earth is the best floor for a duck-house, and this should be heavily bedded with soft hay. In Hammonton and on Long Island they use salt hay, as it is much softer than the ordinary arricle.

Five drakes and twenty-five ducks can be run together with a good chance for fertile eggs.

Rankin says the time for marketing young ducks depends altogether upon the breed. A Pekin will mature at nine or ten weeks as much as a Rouen will at twelve. Ducklings should be partly feathered out before marketed, but do not allow the second crop of feathers to start, as they will be full of pin feathers and somewhat off condition—indeed, no heavier than they would have been if killed two weeks before.

Ducks are very peculiar about laying. They will often lay an egg and consider several days before they produce another, but when once fairly at it will produce an egg almost every day. The first eggs are rarely fertile.

Ducks make very good incubators, but remarkably poor mothers, and contrive to get rid of a large share of their progeny unless confined and closely watched.

They are good for breeding purposes till they are six or eight years old.

Rankin says:—"The best food we have ever found for young ducklings is one part hard boiled egg (we use infertile ones) and three parts stale bread crumbs, the first three or four days; after that equal parts of wheat bran, cornmeal, boiled potatoes, with a little beef scraps thrown in." The Long Island breeders add about a pint of coarse sand to the mash for grit purposes.

A duck-raiser, giving his experience in the *Rural New Yorker*, says ducks are easily hatched, and if properly managed are easily raised—much more so than chickens or turkeys. Probably the worst thing for ducklings is the first thing they usually receive, and that is, unlimited range and water to swim in. The little things are, in a measure, nude, and should be kept in pens with dry soil floors or stone pavement that can be washed down daily. No kind of poultry will succeed on bare boards. All the water they need is best furnished by burying an old pot in the ground and laying a round piece of board on top of the water, with room for the ducks to stick their heads in and fish out the corn that is put in the water. This amuses them and does no harm, while if allowed to go to ponds or streams they are very liable to fall a prey to vermin in some shape, or to get their bodies wet and chilled from remaining too long in the water.

Ducks are enormous eaters. They feed not only incessantly all day, but if it is moonlight they will up and at it again every hour or two before morning. We know of no statistics to show how many pounds of corn it requires to make a pound of duck, but we do not know that ducks are rapid growers, and, if penned and judiciously fed enough to make the most rapid growth, will return a handsome profit for the food consumed.

To be bred successfully, says an English authority, ducks must have water which they can swim about in, and also have a reasonable amount of liberty. Those who live near running streams, or have a lake or pond in close proximity to them, have the matter settled favourably, though perhaps a little more may require to be done with a stream if it be but a shallow one

Mr. Rankin, however, says that, contrary to the general acceptation of the thing, it is not necessary for ducks, either old or young, to have access to a pond or brook, as simply giving them all the water they need to drink is all-sufficient. Indeed, they thrive better and grow quicker confined in yards, with just enough water to drink. Shade is one of the essentials to duck-growing in warm weather, also plenty of green food and vegetables. Ducks are gross feeders, but not particular as to quality.

Referring to general management, Mr. Rankin, in the *Poultry Keeper*, says:—

"We keep them in yards, with wire-netting 2 feet high. Some of them dress over 10 lb. per pair, the average being about 9 lb. per pair. It is necessary to have water dishes so constructed that they can drink freely without getting wet themselves. We use galvanised iron tanks, about the size of a 6-inch pipe, tight at one end and open at the other. Small holes are bored through this tank about a quarter of an inch from the top. It is then filled, or partly filled, with water, according to number and size of ducklings, and inverted into a tin saucer half an inch deep and about 1 inch larger in diameter than the tank, leaving a ½-inch space for the ducklings to drink from between that and the tank. The water will ooze out of the little holes just as fast as they can drink it, and no faster.

"Ducklings should be fed about the same as chicks for the first few days, giving them milk, if to be had, by mixing their food with it. Care should be taken the first few days to keep the young ducklings warm and dry. For the first week they will suffer more from cold and wet than chicks; after that time they will endure more of either than chicks. Cornmeal, exclusively, is too concentrated, and will cripple them in their legs and feet. It should be mixed with bran, boiled potatoes, &c. It is a pleasing and comical sight to see three or four hundred young ducklings when first out. They are much more interesting than chicks, hardier, and if well cared for the mortality is much less."

Campbell says ducks that are kept for breeding purposes must have a pond or water of some kind to swim in, else the eggs will be largely infertile, and there is usually quite a large percentage of addled eggs in them, imperfect germs, &c. This does not agree with Mr. Rankin's experience, who generally has a very large percentage of fertile eggs, and confines his breeders on land altogether. On Long Island some of the duckers use water for their breeding birds, and others do not; but Mr. Hallock, who uses water, told the writer that he did not believe it made much difference either way.

Hatching.

Duck-eggs require turning, and the same general handling as hens' eggs, during the period of incubation, says Mr. Rankin, and the same amount of heat, with a little more moisture after they begin to pip.

Cooper says duck-eggs are not more difficult to hatch than hen-eggs, and require about the same general treatment. The only point to bear in mind is that they require more air because they are larger, and are more difficult to dry down. The air cell will have to be larger than in hen-eggs, so as to give the duck room to turn its somewhat large head and bill. The operator will have difficulty in a damp location in drying the eggs sufficiently unless care is taken. Temperature should be 103°, with a tendency below rather than above: cool a little more than for a hen-egg.

Campbell says duck-eggs and hen-eggs can be hatched together, but will hatch best if by themselves. The shells are very tough, and many of the young ducks will have to be helped out, but when they are out they will soon be as lively as crickets. Great care must be used to give the help at the proper time, as if done too soon the ducks will die.

"Ducks are unlike chicks in that respect," continues Mr. Campbell; "a chick that cannot get out alone is seldom worth helping out, but a duck that is helped out is usually as good as the one that can get out himself.

"Ducklings are like chicks in that they require no food for twenty-four hours after hatching out. They should first of all be given a few drops of water, using care not to let them get wet. They should never, under any circumstances, be allowed water to swim in until they begin to feather; then water will do them no harm, but they must have it before them at all times to drink and wash their bills.

"The same food that is good to raise chicks on will raise ducks. It must be quite soft at first, and a little water must be placed so they can get a dip with each mouthful. Young ducks cannot swallow unless they have water with each bite. A duck does not swallow its food like any other creature I know of; it seems to get the food down by a number of spasmodic jerks. There does not seem to be any action of the muscles of the throat in swallowing, and they choke very easily unless the food is soft, and they have water.

"In hatching duck-eggs they require just the same heat as a hen's egg. They start more slowly than hens' eggs, and cannot be tested with any certainty until the fourth or fifth day; then, if perfectly clean, the germs will show quite plainly.

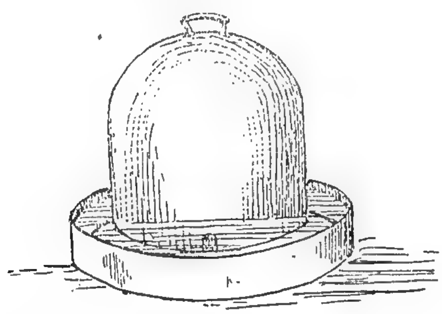
"They will generally chip the shell thirty-six to forty-eight hours before they get ready to come out, and should be turned with opening up, and left lie still until they get ready to come out. It is well to examine and see if they have broken through the lining of the shell, as often it is so tough that they cannot break it even after the shell is broken through, and would smother for want of air. Open a very small hole to give them air, and that is all that should be done until the duckling is trying to get out. Then if it is turning round and round and not able to break the shell as it goes, help it by taking off the top shell. There is no danger of bleeding after they have begun to turn around, but until they do they will bleed; and although a little bleeding will not kill, it weakens them more or less. After they are out let them alone in the incubator until they are quite dry, then remove to a brooder that is 100 degrees, and let them remain for twenty-four hours. After they have been fed once or twice they require about the same heat as young chicks. Run the brooder down to 90 degrees by the time they are a week old. After the feathers appear on the breast all they need is a dry place to gather in at night. They do not need artificial heat unless it is cold weather; then it is best to have it."

The idea somehow or other got adrift some years ago that duck-eggs require more moisture than hens' eggs, in the main, on account of being a water fowl. Mr. Rankin's attention being called to this, he replied:—

"It is a mistaken idea that duck-eggs require more moisture than hens' eggs. They require the same heat and the same amount of moisture, and precisely the same treatment in every respect. They usually pip forty-eight hours before they get ready to come out, and in the meantime are absorbing the yolk. Too much moisture in your machine is disastrous, as your duckling will pip and show his bill one-quarter inch out of the hole he has made from sheer pressure from the inside. He cannot get his bill back, because the shell is closely packed with the bird, and he cannot work his bill either way to break away the shell, so that he is sure to die without help. Duck-eggs should be evaporated, like hens' eggs, the first week of the hatch, as the embryo duck will enlarge so much the last week of incubation that the shell will be densely packed, and that usually means dead ducks. You cannot get too much moisture the last part of the hatch, but during the first part the eggs should be slightly evaporated. The ducklings with us begin to pip the 25th day; on the 27th they begin to come out, and in six hours they are usually out—a squirming mass. But whenever we see one with his bill through we always break the shell away on each side, to give him a chance to get out.—*Garden and Field.*

Water Trough for Fowls.

THE importance of clean, cool water for fowls, especially during the hot season, is of the greatest importance, and yet it is a matter greatly overlooked by owners of poultry. The usual water vessel is a tin dish placed on the ground, where it is liable to be upset when the birds step on to the edge, or else, worse still, it is sunk in the ground and so becomes a sink for dirt and rubbish as well as a danger to young chickens which cannot get out should they slip in whilst drinking. At the Penal Establishment at St. Helena, a very simple and ingenious contrivance obviates all difficulty, and the poultry have a constant supply of clean, cool water. The apparatus consists of a round zinc trough about 2 inches deep. In this stands a zinc dome having only one small aperture near the bottom, about 1¼ inches square. The dome is laid on its side and filled with water through the hole. It is then lifted by the handle at the top and placed in the trough. The water will run from the dome in just sufficient quantity to nearly fill the trough. Thus a constant supply is kept up, so long as there are 4 inches of water in the dome. The latter can, of course, be made to hold 1, 2, or 10 gallons, if required. With this simple apparatus, forgetting to give the bird water, as is often the case in a dry yard, is not productive of serious consequences, as the supply will last for a long time, whilst a capsize is rendered impossible, and the smallest chicken cannot by any possibility get drowned.



The dimensions of the apparatus are—

Dome or cylinder, 12 in. × 12 in.

Trough, 16 in. in diameter, 2 in. in depth.

Capacity, about 5 gallons.

The aperture must be less in height than the dimensions of the tray. The tray or trough must of course be water-tight, but need not necessarily be cylindrical in shape.

An oil-drum will make a capital cylinder.

Lemon Growing and Curing.

[Read at the Conference of Australasian Fruitgrowers—Brisbane, June, 1897.]

BY W. S. WILLIAMS, VICTORIA.

I HAVE endeavoured in the paper I am about to read, to state everything as plainly as I possibly can, and if any delegate fails to see the meaning of anything now read I will, when I conclude, do my best to answer any question which he may wish to ask.

STOCKS, RAISING AND WORKING.

The best stocks for lemons I find to be strong seedlings from the Sweet Orange. Lemon stocks have all been failures with me, and Seville stocks too slow in growth to match the lemon.

Budding I find the best method of working. It always makes a better tree than grafting. The stocks should be budded well up from the ground, as if worked low they are liable to take collar-rot disease at the point of union.

SOIL.

The most suitable soil for the culture of lemons, I find to be a deep fine loam, with clay subsoil, which should be underdrained, as stagnant water causes the roots to rot. They also do well on light chocolate soils and red soils intermixed with ironstone gravel.

The cleanest and most vigorous trees I have ever seen were grown on the last-mentioned class of soil.

PREPARATION OF THE SOIL.

To prepare the soil for planting, two ploughings should be made, crossing each other and subsoiled to a depth of not less than 12 inches, and left to lie fallow through the summer and in autumn, the land should be well worked and fined with disc harrow and further fined and levelled with the Acme harrow, then gathered in lands of 20 feet with the plough, and finally worked lengthways with the Acme, which will bring it into good tilth. If the land is stubborn to break, the roller may be used with advantage.

PLANTING.

I find 20 feet by 20 feet is the best distance at which to plant in my district, and a strong wire marked every 20 feet, stretched across the lands, I find the best and truest method of planting by. The wire marks should come on the crown of the lands, and the trees planted at each mark. Care should be taken, in planting, not to plant deeper than the nursery mark, as the top roots should be only just covered with soil, which should have a decided fall from the neck of the tree; otherwise they may contract collar rot through water lodging round them.

SITE.

The best site I find to be a north-east slope, which will give shelter from westerly and southerly winds. In order to produce a good percentage of clean-skinned, saleable lemons, they must be sheltered from heavy winds either naturally or artificially. I have some very much exposed and others well sheltered, and any person at a glance can see the difference in trees and fruit.

On the other hand, in undulating country, they should not be planted in gullies, for then the frost destroys large portions of the trees and fruit; indeed, in several instances I have seen them totally destroyed.

SHELTER.

For artificial shelter, if there is plenty of land-room, nothing to my mind beats *Pinus insignis* planted 20 feet apart in the rows, the second row planted 10 feet from first or more, at the discretion of the grower, these trees to alternate with the first, and in six years they will come together and form a perfect break-wind 20 to 30 feet high.

A double row of loquats alternating makes a good break; and if they have been well selected and are properly attended to, the fruit will be a source of profit. Then there is the Brundis almond, a very upright growing sort, which bears good fruit, and is also of some profit; some object to it on account of its being deciduous. It is, however, only a very short time bare of foliage.

Diseases.

Collar rot is a disease of the bark at the neck of the tree, the cause of which I should not like to assert for certain, but hope to be enlightened on the matter by some of the gentlemen present at this Conference.

I have found that, if the disease is detected in time, it can be stopped, and the tree will regain its health and vigour. I find that, to remove the affected part, to clean and paint it with olive and carbolic oils in equal parts, will, in almost every instance effect a cure; the difficulty is in discovering it in time.

Generally, the first visible intimation of the disease is the fruit setting abnormally thick, and the foliage turning a sickly yellow colour.

The true collar rot affects the tree from the neck upwards, while the roots below are perfectly sound, and will remain so for a long time after the tree is dead.

Root Rot.

This disease is of a more deadly character, as it begins in the subsoil at the extremities of the roots, and proceeds upwards until the tree dies. Once a tree is affected, there is no cure. The cause of this disease is bad drainage and stagnant water, which poisons the roots; or it may also be caused by some deleterious substance in the subsoil, such as salt, copper, antimony, or other poisonous minerals. Many people mistake it for collar rot, but they are totally different in their symptoms, and are brought on by totally different causes.

Insect Pests, Scale, &c.

In my district, the lemon is infested by four different kinds of scale. These comprise, I believe, some of the worst of their species known up to the present. At all events, if there are any worse, I hope I shall never have the misfortune to contend with them. The first is commonly known as the "Red Scale" of the orange and lemon (*Aspidiotus coccineus*), a native of Europe, immigrated or introduced to this beautiful continent for the especial annoyance, vexation, and loss of the Australian citrus-grower. There are very few places in Victoria or in any of the other Australasian colonies unaffected by this pest.

Generally, the first indication of its presence is on the fruit, which it deteriorates in value, especially for table use. For peel-making it is not of so much consequence, as it leaves the skin while going through the pickling process, but it seriously damages the tree and in time kills it.

I am thankful that so far, I have succeeded in keeping this pest in check, and trees which, when I first discovered them to be badly affected by the scale, can now be looked over very carefully before finding a single specimen.

No. 2 is the common Soft Brown Elongated Scale. This I believe to be a native of the colony, as I have seen it on native shrubs about the creeks. It is very prolific, and its worst feature is its very dirty habit of ejecting abdominally a drop of honeydew, which bursts into a spray when ejected and sprinkles the leaves, fruit, and wood of the tree, on which a black fungus grows, displeasing to the eye, very hurtful to the tree, deteriorating the market value of the fruit, and necessitating washing to make them saleable. This scale is easily kept under.

No. 3 is *Icerya Purchasi*, commonly known as the Cottony Cushion Scale, a native of Victoria, as I have often seen it on the native wattles in my district, and have found it on two occasions on lemon-trees, but only just started, so that it was easily exterminated. Its white colour makes it very easily distinguishable. This scale, which is said to have done so much damage in America, and which is so much dreaded in other countries, lives in my district within a few hundred yards of thousands of lemon and orange trees, and I am thankful to be able to say it has only made two attempts to settle on them, and on each occasion was luckily detected at once.

No. 4, *Lecanium oleæ*, or Olive Scale (called in America "Black Scale"), is the worst scale I have to contend with. It has been the cause of great trouble and expense to myself and others in my district. Once let it have a good start, and it will increase in countless thousands in one season, and will cover all the leaves and branches it attacks. It frequents apples, plums, peas, and quinces, but none so virulently as the orange and lemon. I have found that this scale distributes more honeydew than any other I am acquainted with, and consequently it creates more black fungus. The leaves, branches, and fruit, in damp weather, become coated with the fungus, and if not checked, will so injure the trees that they cannot bear, and only just manage to live. The tops begins to die off, and in the course of a few years the tree gives up the fight. I have been a very close observer of this scale for this last couple of years, and find that they never stop hatching right through the winter. I have opened what I call the mother-scale, and always found some full of young in the running stage

a little smaller than hen-lice, and on the scale being opened they nimbly scatter in all directions, and, when they find a suitable place, settle down, and in the course of fourteen days or so develop into a very distinguishable scale of a light-brown colour. The underside of the leaves, along the centre rib, is a favourite resort with them, but they are in no wise particular; the scale itself, however, seldom settles on the fruit. Others on being opened, will shed thousands of little pink eggs, like fine sand, which are only awaiting the proper period to elapse to have legs to transport themselves over the tree.

I have never been able to distinguish any male, or to ascertain how they get from one tree to another, as they have no wings at any stage of their existence, and I do not think they travel over the land. I can only account for it through birds flying from one tree to another and carrying them on their legs or feathers. As we have entomologists and experts from the different colonies at this Conference, I hope to get some information on this point.

So far as my observation goes, I do not think the Soft Brown Elongated Scale or the Olive or Black Scale will thrive to as great an extent in a warm climate as they will in a more temperate one, as I have seen very little in the northern parts of Victoria.

There are native enemies in my district for three of these scales. The red and brown are both bored through the centre by a small fly, and the inside is extracted and only the hollow shell remains. The ladybird also destroys them in the young stage.

The mother-scale of the olive, when full of eggs, is entered by a minute, dirty, grey, hairy maggot, which clears all the eggs out of the shell. I have found a great number this season treated in this manner. The ladybird also has its share of the young when in the tender stage.

A proper scientific description of the scale insects I have mentioned can be seen in Mr. C. French's "Handbook on the Destructive Insect Pests of Victoria"; also, in a book on Scale Insects by Mr. Maskell, of New Zealand.

Method Discovered and Adopted by the Writer for the General Destruction of Scale Insects by Spraying.

The insecticide used is pure kerosene of 150 test, mixed with cold water by a new process and sprayed on to the trees affected. It is simply kerosene and cold water carried in separate vehicles and amalgamated in the pump under pressure. This new process does away with the time and trouble of making kerosene emulsion, and has the advantage of preserving the full insect-destroying power of the kerosene until it reaches its destination through the spray nozzle, which power it loses, to a considerable extent, through evaporation in making emulsion.

The proportions I use in summer for Olive Scale are 1 of kerosene to 20 of water, which can be sprayed on to lemon or to orange trees with perfect safety, and has the effect of cleaning the trees of all black fungus, and if the tree is properly sprayed, not one scale in ten thousand escapes with life.

For Red Scale, I use it stronger. The Brown Scale is easily killed with 1 in 20.

Some years ago, before I had perfected this process, my trees and fruit were quite black, the trees very sickly-looking, and the fruit unsalable without washing everyone. Now they are, I will not say, perfectly clean, but so clean that it is not noticeable unless by a very close observer. My trees have had only five sprayings in two years, and the last two sprayings have averaged little less than a case of kerosene to the acre over twenty-six acres.

I also grow apples, pears, plums, and cherries. These I sprayed in winter, when the leaves had fallen. The red spider eggs, and woolly aphis, and the scale (the olive) were completely done for. The deciduous trees in winter can stand 1 in 10, and I believe a much stronger mixture. The pears and cherries I sprayed in summer for the pear slug (with which we are badly infested), with 1 of kerosene to 45 of water, which killed every slug and with no harm to the trees or fruit whatever.

There is one of the pumps with kerosene attachment sent here for exhibition which members of this Conference can see tested, which will give a far better idea of its working than any explanation I can possibly give.

I may add that impure kerosene is dangerous to trees of any sort, because of its burning character.

Manuring.

I use blood manure, superphosphate, bones, and a small portion of kainit alternately, also sulphate of iron if a tree should look sickly. I also use stable manure when I can get it cheap enough, as it tends to keep the ground loose about the trees; peas sown in autumn and ploughed in early in spring, I find very beneficial, as they add nitrogen to the soil and keep it open. Around lemon-trees, the soil should never be allowed to set. I do not mulch outside the drip of the trees, as it tends

to bring the roots too near the surface, and so interferes with working the land during summer. After every fall of rain of any consequence during summer, the land between the trees should be gone over with a disc harrow or cultivator and loosened to a depth of 3 or 4 inches, and underneath the trees the long-handled Dutch hoe should be used, so that moisture may be retained in the soil. In a well-kept orchard, the foot should always sink in the soil, and no weeds ought to be seen during summer.

Irrigation.

I very early found, even so far south as Melbourne, that, for the successful culture of lemons, it was absolutely necessary to have the command of water, as there is generally a short portion of each year when the trees are liable to suffer from want of moisture; and if water be not at hand when wanted, the trees suffer in their growth and bearing. During some abnormal seasons it is not required, but we never know until the time comes; and when the leaves begin to curl, it is certain they want a drink to carry them forward, and, if this be not supplied, it means all the difference between loss and profit.

Any person choosing a site for growing lemons should see that he choose one where he can have a supply of water.

The method I adopt in applying water to the trees is to plough furrows on each side of the trees both ways, outside the drip, and run them full of water as evenly as I possibly can, and next day, when the water is soaked into the soil, run the disc over to fill the furrows and leave it loose.

I find a fair watering will carry the trees over a month, at least, in the driest time.

Pruning.

In the matter of pruning, I have searched and inquired in every place I have visited where citrus fruits are grown for a system, but so far have found no general system recognised. Some growers never cut a tree under any circumstance, and say it is wrong to do so. Others, again, trim the tops to give the tree symmetry and balance. Such plans may do for some years, but ultimately the trees suffer and die a premature death, as the lemon, as a rule, is a very heavy bearer, and, if left to nature with regard to pruning, it kills itself by bearing. After some experience, I have come to the conclusion that lemon-trees should be systematically pruned. The best time for this operation is in spring, and by what I term "back-pruning"—that is, beginning in the centre of the tree and removing a portion of the offshoots from each limit outwards, always taking care to leave foliage enough to shade the inside of the tree. A main point is to keep the tree fairly balanced by removing strong stem shoots, and keeping the tree growing evenly all over, for if one portion is allowed to take the lead it does so at the expense of the other portions of the tree, which, besides rendering it unsightly, also injures its bearing powers.

The above, if followed out, gives the tree proper air and light, renders it less liable to insect pests, and causes the fruit to come more even and clean inside and outside alike, besides adding very materially to its length of life.

Gathering and Curing.

Lemons, to have the best colour and quality for table use, should be cut off the tree with a proper fruit-cutter and handled with great care, or else a large percentage will spoil in the curing; they should be taken off when the fruit is changing colour, and left for a day or two in the open air before putting away.

They should be placed in trays in single layers, and placed in a dark dry cellar of even temperature, not at any time over 60 degrees. The trays may be placed on each other to any convenient height, and in three weeks should be moved and examined, and wasters removed. They should be gone over again in the course of a month, when all that are likely to go wrong will have had time to do so. The lemons are then perfectly cured, and should be of a beautiful bright-yellow colour. The cells are decomposed and give out the juice freely, and of far better quality than if taken off the tree direct. The lemons can then, if wrapped in tissue-paper, be sent any distance if kept moderately cool and dry, or stored to meet the changes of the market. I have kept lemons repeatedly twelve months with very little change after the first seven or eight weeks.

I have often privately marked my own cured lemons, and mixed them in the market with best Italian imported, and enjoyed the pleasure of seeing experts trying to separate them, which they seldom succeeded in doing correctly.

Strawberry Culture in Victoria.

[Read at the Conference of Australasian Fruitgrowers—Brisbane, June, 1897.]

BY W. S. WILLIAMS,

Doncaster Fruitgrowers' Association, Victoria.

To grow good sound strawberries of good flavour, a clayey loam soil is required for some sorts and a heavy clay soil for others.

The Marguerite, Edith, British Queen, Arthur, and many others thrive best in soil of the first description. Trollope's Victoria requires clay in order to attain perfection.

To prepare the land for strawberries, a piece of new land should be selected, or land that had been in grass for several years. It should be ploughed twice (the second ploughing crossed) to a depth of 10 inches or 1 foot, and left over the summer in fallow. About the 1st of March it should be well broken and fined by disc and acme harrows; then gathered into lands, the width of which should be determined according to the character of the soil—if wet, in narrow lands, and broad if dry; then a dressing of Thomas's phosphates and kainit, of from 5 cwt. to 7 cwt. to the acre if fairly good land, should be given—more if the soil be poor and hungry; or the same quantity of superphosphate of bones with one third of kainit may be used. This should be sown on the land broadcast before harrowing; then harrow and fine down, making the lands as level as possible, and finally roll with a heavy roller twice to well consolidate it.

The land is then fit for planting. Weather permitting, the best time for planting in my district is the latter end of March and on through April. The earlier strawberries are planted the larger will be the crop in spring, and if everything is favourable the fruit should prove to be very fine. I have planted strawberries at many different distances apart; but the best distance I have found to be 3 feet apart between the rows and 10 inches or 1 foot in the rows. This gives plenty of room to work with horse and hoe. The crown of the plant should be kept above the ground in planting. To keep the rows true and straight they should be planted one side of a tightly stretched wire or line, so that working with the horse the implement disturbs the soil at an even distance from the plants all along the drill. Just as the plants begin to take root they should have a strewing of blood manure or other nitrogenous substance around them, to be worked in with horse and hand hoe. At this period of their existence all weeds should be strictly eradicated, as on this particular depends in a great measure the future success of the planting.

In working the strawberry drills, I have always used the Planet Junr. horse hoe since it was first imported, also an onion skim plough. The last working given in autumn, before the wet weather sets in, is with the Planet Junr., set behind with left and right small steel mould-boards, which gather the soil from plants on each side and make a clean even ridge at one stroke, leaving the plants standing in a row of undisturbed ground about 8 inches or 9 inches wide, according to the size of the plants. In this condition it is left during the winter, which gives the water free access to run off the raised middle, which thus lies dry and is mellow to work down in spring, which having been done the earth is again lightly raised in the middle, the weeds cleared off, and the plants mulched with straw or grass. The slight indent made by the hoe gives the straw or grass mulching a bed, and is less liable to be dislodged by wind or pickers.

Some people mulch with stable manure and tan from the tanneries, both of which I have found very inferior to straw or rough grass or rushes. The ammonia in the stable manure rots the berries, and renders the skin too soft to stand the carriage; the tan creates fungus in the ground which destroys the plants.

Strawberries, everything being suitable with a favourable season, with me, have been enormous bearers, particularly Edith and Marguerite. Off a piece of land of 10 acres, planted with lemon-trees, 20 by 20 (the trees taking about 11 feet, and three rows of strawberries the remainder), my largest quantity delivered in Melbourne in one week has reached 3 tons. These were all picked each morning between 4 and 8 o'clock, and the fruit delivered before 10 a.m. The fruit was gathered in 1-lb. chip baskets and packed in crates of 32 and 40 lb., which is the best system for carrying berries or early peaches I have yet seen.

The strawberry, in the Melbourne district, is subject to a number of insect pests and other diseases. The worst of the former is a native beetle which bores through and along the stems out to the crown, thus destroying the plant very quickly, and rendering it necessary to plough in the plants every three or four years and replant in a clean place. I have several times tried replanting on the same land after several years have elapsed, while the land has borne other crops or has lain in grass, but never succeeded satisfactorily in getting any good from it. In some years, the fruit is very much destroyed by slugs. I have generally used chimney-soot for slugs and thrips (when in flower) with success.

There is again the "root fungus," a white substance that spreads over the roots and neck of the plant and soon kills it; and again what I call "wire fungus," because it is like a small black wire. This knits itself around the roots and neck of the plant, and fairly throttles it to death in a week or so.

Where land is known or suspected to contain those fungi, a good dressing of lime and kainit, ploughed in during the last ploughing before planting, I have found a good deterrent for those plagues.

I do not know that I can say anything more on strawberry culture. I have heard it stated by some of my acquaintances, that it is necessary to have plants that bear male flowers, to impregnate the female flower with pollen, so that good bearing will be assured; but as I have never found a plant in my place that did not bear when it had the chance, I came to the conclusion that Nature had provided what was necessary without my intervention. For all that, I have not the slightest doubt that, in many cases, it is necessary to search into and closely investigate those little tricks of Nature with a view of knowing how to twist them to one's own benefit and pleasure.

If irrigation is contemplated, care should be taken to lay out the lands so that water would run along the drills under the mulching. I have found a command of water in a dry spring of great value.

I may also state that this paper does not apply to hand culture. For hand culture the distances apart would very materially differ, as would also the method of planting and the shape of the land.

Report on Insecticides Exhibited at the Conference of Australasian Fruitgrowers, Brisbane, June, 1897.

THE following report of the judge of insecticides has been handed to the Under Secretary for Agriculture by Mr. William Soutter, Curator of the Acclimatisation Society's Garden :—

JOHNSTON'S SPECIFIC.

This specific has a great advantage over the competing compound, in so far as it requires no heating to render it soluble.

EXPERIMENTS.

1. One application on peach-trees badly affected with Green and Black Aphis. The result was completely satisfactory.
2. One application for White Scale on roses and on the Rubus family made a great impression. A second application had the effect of killing nearly everyone of these insects. The same result was attained on orange trees after the third application.
3. One application for Fern Weevil and Wire Worm had beneficial results.
4. Red Spider and Thrip readily fall victims to the insecticide.
5. The Caterpillars, which so badly affect the edible fig, were all killed by one spraying of a weak solution. The Beetle, of which the caterpillar is the progeny, was also killed by one application of a stronger solution.
6. *Wax Scale.*—A considerable amount of attention was directed to this pest, and four applications, at intervals, were made. The first spraying had no visible effect. The second resulted in the scales (wax) changing colour from a rose shade to a dull white. At the third application the whitish appearance was intensified. As a result of a fourth spraying, about 80 per cent., at present, of the scales are dried up and dead, while the remainder are still alive, although not so red in colour as those on plants not sprayed. I believe that three or four sprayings during November, December, and January would go far towards cleaning trees of the Wax Scale. The result with this scale may therefore be said to be fairly satisfactory.

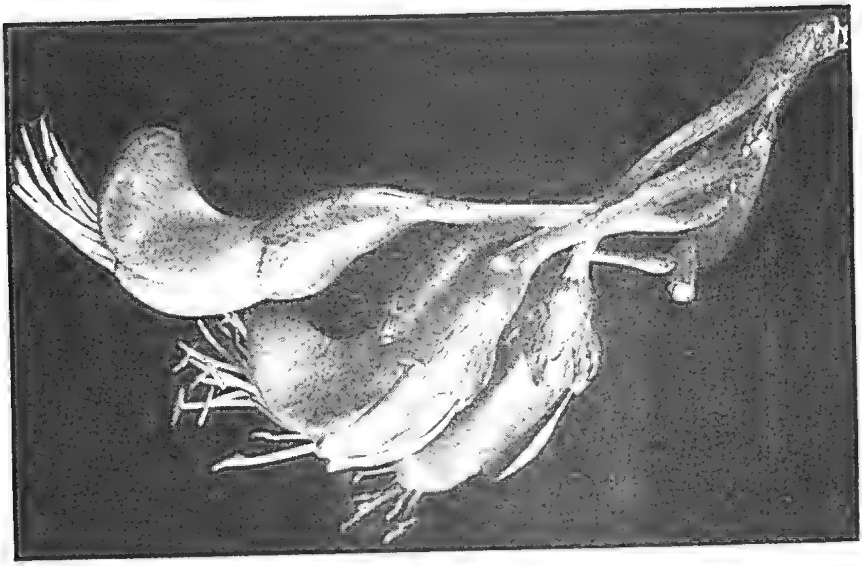
With flying insects, few opportunities have been afforded during the winter to try the effect of the compound.

The result of the experiments, though spread over a period of nearly six months (too short a time to give any insecticide a full trial), has proved that a summer trial would, in my opinion, be much more interesting, and give much more marked results, as during the summer months most of the insects are much more active than during the winter months. I place Johnston's specific first, for the following reasons :—

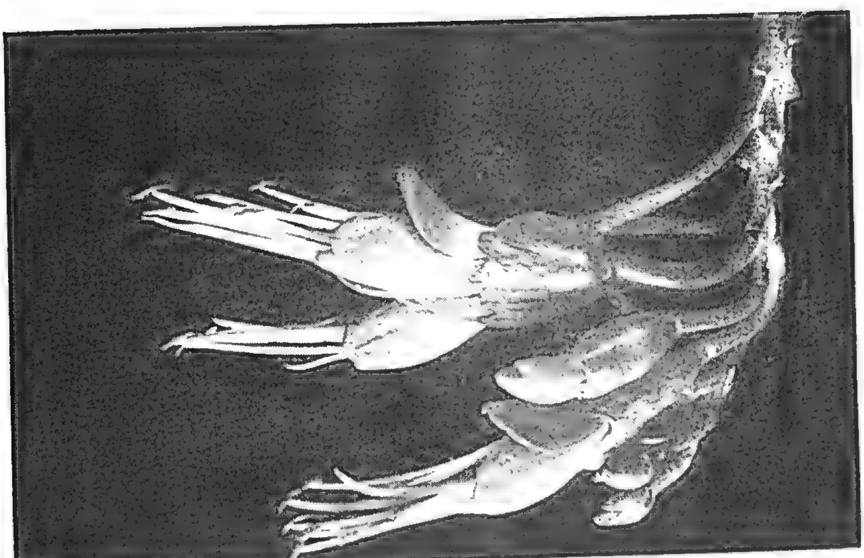
1. The facility with which it can be mixed ready for use.
2. The rapidity of its killing action.
3. The soluble nature of the compound is such that it can be used with the fruit spray distributors.

DAVEY'S SPECIFIC.

This, although an excellent insecticide, is too cumbersome in its present form to handle; and the necessity of heating the same before mixing, and applying it hot to the plants, renders the work too laborious. The nozzle of the spraying pump is liable to choke as the compound cools. Get rid of these two objections, and Davey's insecticide might hold its own with most specifics.



CASTANOSPERMUM AUSTRALE, CUNN.
(NORMAL FORM.)



C. A., Var. BREVIVEXILLUM.

Botany.

CONTRIBUTIONS TO THE FLORA OF QUEENSLAND.

By F. MANSON BAILEY, F.L.S.,
Colonial Botanist.

Order PITTOSPOREÆ.

PITTOSPORUM, Banks.

P. setigerum, *Bail.* (n. sp.) A small glabrous tree. Branchlets furrowed, with the bark often reddish. Leaves coriaceous, the reticulate veins close and raised, 2½ to 4 in. long, ¾ to 1 in. wide, tapering from above the middle to a rather long slender petiole, the apex terminating in a prominent bristle. The flowers judging from the dried specimens light-yellow, in broad spreading terminal panicles longer than the leaves. Pedicels slender. Sepals broadly-ovate, minute. Petals free, patent, about 2½ lines long, obtuse, veins obscure. Stamens shortly exceeding the petals. Ovary on a short glabrous stipes, densely covered with a white tomentum. Capsule globose, 4 lines diameter, exuding an amber-coloured resin or gum. Seeds black, angular, from 2 to 6 in each capsule.

Hab: Walsh River, *T. Barclay-Millar.*

CASTANOSPERMUM, A. Cunn.

C. australe, *A. Cunn.* Moreton Bay Chestnut or Bean-tree. Mr. Soutter recently drew my attention to a remarkable form of this tree growing in the grounds of the late Mr. John Petrie, on Gregory terrace; and with a view of bringing the matter more prominently under notice, I here give a description and figure of the normal as well as the new form. Mr. Soutter states that, although he has noticed the tree to bloom before, he does not remember to have seen any pods. It does not follow that plants raised from seed of this variety would produce flowers similar to the parent, but persons desirous of having plants could do so by grafting upon seedlings.

Normal Form.—Racemes 2 or 3 in. long, nearly or quite sessile. Pedicels 1 to 1½ in. long. Calyx coriaceous, campanulate, ½-in. to ¾-in. long, lobes 5, short and broad, the 2 upper ones more widely separated and shorter than the others, all incurved. Standard obovate, prominently emarginate or 2-lobed, tapering to a rather broad claw, 1 to 1½ in. long, and when fully expanded 1 in. broad, wings and keel petals imbricate, erect, ¾-in. longer than the calyx-tube, oblong, all the petals thick-coriaceous, changing from a greenish-yellow to a deep-orange. Stamens 10, all free, incurved, the longer ones 1¾ in. Anthers linear, versatile, 2 lines long. Ovary on a long stipes, with several ovules, tapering into an incurved style. Stigma minute. (*See* Plate.)

C. a., var. brevivexillum. This variety differs from the normal form, in that its flowers are smaller and of a canary yellow, and the standard being shorter than the wings and keel-petals, and of nearly the form of these, and but slightly recurved. Stamens nearly straight. (*See* Plate.)

Order URTICACEÆ.

FICUS, Linn.

F. esmeralda, *Bail.* (n. sp.) Described by collector as a very attractive shrub, with orange-yellow fruit. Branchlets very slightly scabrous, sulcate. Leaves nearly or quite glabrous, alternate, oblong or some of the smaller ones lanceolate, 1¾ to 3¾ in. long, 1 to 1¾ in. broad, base oblique, rounded or cuneate, the apex more or less abruptly terminating in a short or rather long point, margins entire; primary lateral nerves nearly horizontal, about 9 on either side of midrib, the basal pair like the others, all looping near the margin, the transverse reticulation often joining and forming an intermediate pseudo nerve. Petioles very short, seldom exceeding 2 lines, and rather broad. Stipules narrow-acuminate, 5 or 6 lines long, seems to be somewhat tinged with red and slightly hairy near the base. Receptacles solitary or in pairs, axillary and lateral on peduncles of ½-line, globose, about 3 lines diameter, on a stipes a little longer than the peduncle, marked in the lower half by 6 ribs; basal bracts 2, broad and dark-coloured, inner bracts and perianth-segments from ovate to lanceolate, with ciliate margins. Could find no male florets in the receptacles examined. Ovary oblong, style erect, clavate, or cuneate.

Hab.: Mourilyan Harbour, *W. Mugford*, near Esmeralda Plantation.

F. mourilyanensis, *Bail.* (n. sp.) Described by collector as a large tree, bearing its fruit in clusters on the principal stems. Branchlets slender, angular, sulcate-striate between the angles. Leaves alternate, 4 or 5 in. long, membranous on short slender petiole of about 1½ lines, lanceolate with long points, lateral nerves distant and irregular, the basal pair parallel with and near to the margin, joining with the others and forming the looped intermarginal nerve; the transverse reticulation very open, the whole underside of leaf shown with the aid of a lens to be closely marked with dark dots. Stipules lanceolate, about 2 lines, sharply keeled. Receptacles on slender peduncles, about 9 lines long, each with from 1 to 3 loose distant bracts, in clusters on the old wood, starting from a mass of imbricated dark bracts, globose, about 6 lines diameter, umbonate, bracts of orifice purple. Florets male, near the orifice, segments 6, hyaline, purplish. Stamen 1. Anther large, lunate, 2-celled, somewhat resembling a grain of wheat. Florets female, segments purplish, as in the male but rather larger, enclosing ovary and style. Style shorter than the ovary, glabrous, stigma, some oblique, others peltate, concave, and slightly hairy.

Hab.: Mourilyan Harbour, near Esmeralda Plantation, *W. Mugford.* This species is robably nearest to *F. fasciculata* amongst the Australian species.

Order AROIDEÆ.

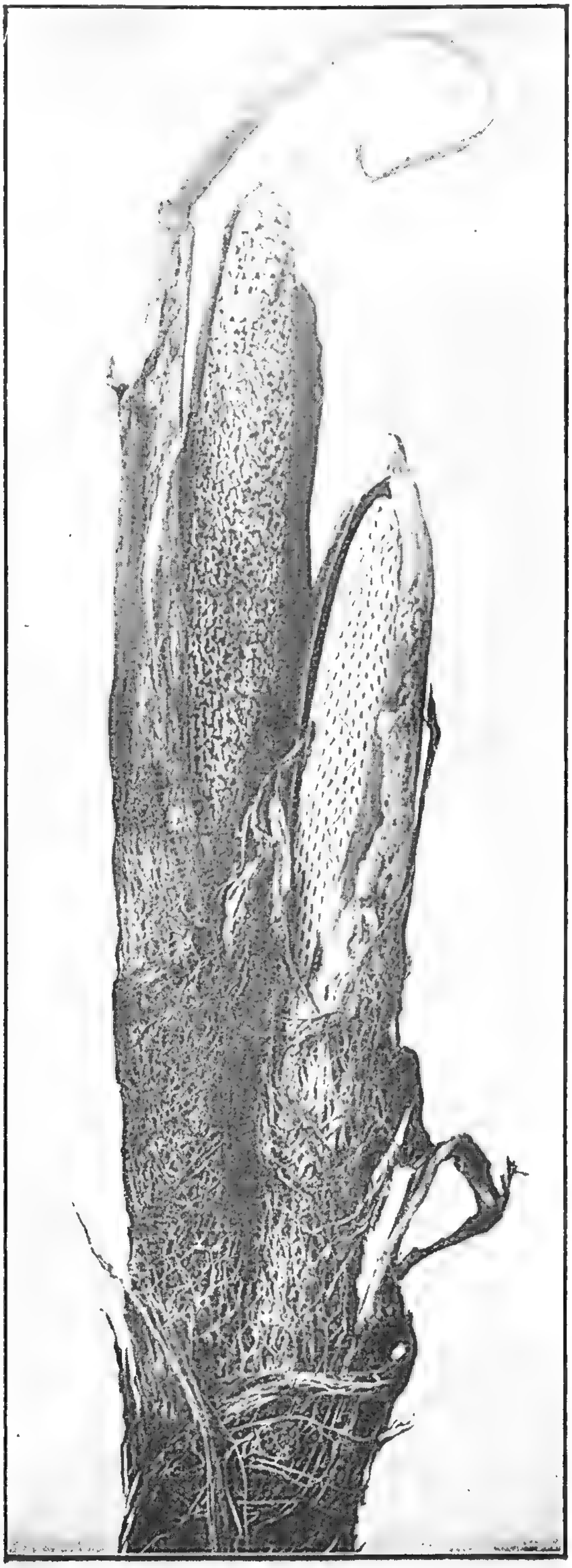
RHAPHIDOPHORA, Hassk.

A few differential characters of the two Australian species—

Spatha very deciduous, 3 to nearly 4 in. long. Ovary conical on the top, stigma linear. Seeds numerous. 1. *R. australasica.*

Spatha not deciduous, 8 or 9 in. long. Ovary flat-topped. Stigma linear, sunk in the ovary. ... 2. *R. Lovellæ.*

R. australasica, *Bail.* (n. sp.) Stems climbing often to a considerable height, angular, not often bearing the fibrous remains of the old leaf-sheaths, usually quite naked, cane-like, emitting roots from the underside; internodes short, seldom exceeding 1 in. diameter. Leaves near the inflorescence entire, 10 to 15 in. long, 3 to 5½ in. broad in the centre, lanceolate or ovate-lanceolate, costa prominent, lateral nerves numerous. Petiole more or less winged, 7 to 9 in.



RHAPHIDOPHORA LOVELLÆ, BAIL.

long from the base to the geniculation, and about 1 in. from there to base of lamina. Inflorescence appears terminal, erect, solitary, or sometimes two near together with little or no network of old leaf-sheaths to support them. Peduncles 6 to 7 in. long, terete, under ½-in. diameter, soft. Spatha deciduous, 2½ to almost 4 in. long, acuminate, rather spreading. Spadix cylindrical, sessile, at first rather slender, attaining a diameter of over 1 in. when in fruit, 2½ to 3½ in. long. Stamens only seen in very bad condition, slightly elevated above the ovary. Ovary somewhat compressed, angular, the apex conical with a linear stigma. Seeds numerous, 26 in one fruit examined, oblong, cuneate, slightly tuberculate.

Hab.: Scrubs on range about Cairns, *E. Cowley.*

R. Lovellæ, *Bail.* (n. sp.). (In honour of Miss Lovell, to whom I am indebted for the ample specimens from which I have been enabled to give the present diagnosis.) A lofty climber. Stem compressed, 2 in. or more in diameter, emitting roots from the underside into the bark of the trees over which it climbs like the ivy; clothed particularly in the leafy parts with a network formed of the fibrous remains of the stipular sheaths. Leaves near the inflorescence pinnatisect, 2½ ft. long, the segments 1-costate, irregular as to length and breadth, often 15 in. long, ensiform and somewhat falcate, usually obliquely-truncate at the end, about 15 on each side of the stout midrib, the lamina of the broader segments sometimes perforated with elongate openings, the 2 or perhaps 3 basal segments often confluent and thus 2 or 3-costate. Petiole channelled, stout, 18 to 20 in. long without the 2 in. between the geniculation and the lamina. Inflorescence appearing terminal, erect, crowded, often as many as half-a-dozen representing all stages from the opening of the spatha to the ripening of the fruit, all bound together by the beautiful network of the old stipular sheaths. Peduncles stout, 5 or 6 in. long, over ½-in. diameter, often hard. Spatha about 9 in. long, at first nearly white, then yellow on both sides, thick, cymbiform, closing round the end of the spadix and ending in an elongated acuminate point. Spadix sessile, very stout, cylindrical, about 8 in. long, pale-yellow. No perianth. Stamens 4, filaments flattened, anthers exserted above the ovary. Ovary truncate, 4-angled. Stigma linear, rather sunk in the ovary, the ovules seem to be 2. Berry very juicy. (*See* plate showing inflorescence.)

Hab.: About 20 miles from Cooktown, *Miss Lovell;* and ranges about Cairns, *E. Cowley.*

The difficulty in obtaining suitable specimens of plants of this order from distant localities is felt, not only in this but in most countries, and it is principally from this cause that we find the published descriptions so frequently imperfect. This trouble is in a measure obviated by the cultivation of the plants, which can only be carried out in Europe at large establishments, such as the Royal Gardens, Kew. But descriptions drawn up from these cultivated plants are often misleading when compared with specimens off the plant in its wild state. *R. Lovellæ* accords in some respects with Hooker's description of the Indian species, *R. decursiva,* but not in my opinion sufficiently to allow of its being recorded under that name. I think it very probable that the foliage of the two Australian species has been gathered by collectors, and is now placed in European herbaria under the name of *R. pinnata,* Schott. The description given in the Flora Austr., vii., 156, does not agree with either of the Queensland species. I have given the description of leaf from near the inflorescence only, as in all probability the foliage varies much in other parts of the plant.

Coffee-growing in Queensland.

BY F. HEPBURN,
An ex-West Indian Coffee Planter.

IN connection with the growth and cultivation of the coffee-tree in Australia, some experts and others have ventilated in the Press and by pamphlets their opinions, &c., which to a certain extent are conflicting and misleading as well as inapplicable if applied to Australia. The writer has given the subject special attention during the past few years, and having personally made recent tests and experiments, also following up the latest reports from the State nurseries, together with communications from various coffee-growers, it is established beyond question that the marked peculiarities or characteristics in the growth of the coffee-tree are so prominent that the experience of a coffee-planter obtained in the northern hemisphere would, if carried out in Australia, on several points be unsuccessful and probably injurious.

At Kamerunga, trees in their fourth year gave a full crop. In other countries a full crop may be obtained in the sixth or seventh year, or about the time when the tree itself arrives at maturity. Here the tree is very far from maturity in its fourth year and second crop. Its prolific nature here is also shown in its bearing fruit on the primaries, as well as on the secondaries and tertiaries; the berries generally are in small clusters and pretty evenly distributed. The yield is also so much greater that the new-chum planter opens his eyes with astonishment—it is not in his experience.

In the late International Exhibition there was a tree in its fourth year carrying its second crop, which, under normal circumstances, would have resulted in fully 3 lb. of parchment-cured coffee. This tree was nearly 5 feet in height, and the lower primaries extended laterally to about 3 feet from the stem. The difficulty with such heavy bearing trees is to give them some artificial support, and Mr. Buchanan's recommendation to allow suckers to remain *pro tem.*, so that the additional roots thrown from them will give the tree a better grip, and be more able to withstand high winds, is worthy of every consideration. Staking such trees in a proper manner, to enable them to withstand high winds and prevent serious injury through friction, would entail considerable expense and very much extra labour. It seems that planting about 1,000 trees to the acre is much in favour. Some growers are planting about half that number; but where suitable soil and well-cleared land are combined, to obtain the best returns with economical outlay, 800 to 1,000 trees per acre will likely prevail. The maximum number with low topping would have decided advantages in exposed or cold positions.

A noticeable thing in connection with the bulk of Queensland-grown coffee is the small size of the beans when cured; it does not follow that the quality thereby suffers. As the trees age, it is likely the size will increase. Cairns produce is to the point. Coffee grown around Brisbane is of larger size, but, as would be expected, a better return is got from an equal weight of berries grown in the North than is to be obtained from a similar weight in the South. Two separate experiments were made by the writer this season, and resulted as follows:—

Ripe berries as picked from the trees	19½ oz.		measured	1½ pints
When pulped gave	10 ,,	and	,,	·625 of a pint
When fully cured (dried) in the parchment	4·32 ,,	,,	,,	·475 of a pint
When hulled and fully cleaned	3·41 ,,	,,	,,	·230 of a pint

The second test was with 2 lb. of berries		,,	,,	2½ pints
When pulped gave	17 ,,	,,	,,	·9 of a pint
When parchment cured	6·43 ,,	,,	,,	·675 of a pint
When hulled and cleaned	5 ,,	,,	,,	·375 of a pint

Comparing the above results with the published reports from Mr. Cowley, of the Kamerunga State Nursery, he states that 1 lb. of pulp (berries) gave $2\frac{1}{2}$ oz. of pure coffee. He again says that from 60 lb. of berries the return was $11\frac{1}{9}$ lb. of pure commercial coffee. This is equal to 2·97 oz. of clean coffee beans from 1 lb. of ripe berries, or 18·51 per cent.

The first test—as detailed above—of the Southern coffee is equal to $2\frac{8}{10}$ oz. of clean coffee from 1 lb. of ripe coffee berries, or $17\frac{1}{2}$ per cent.

As to the cost of picking the ripe berries, which is the heaviest item, it appears that enough labour at present can be had at an expense of $\frac{1}{2}$d. for each pound of coffee berries. Assuming that the average return was only $2\frac{1}{2}$ oz. of clean coffee from 1 lb. of berries, the cost of picking would be 3d. per lb.* The selling price or the price which the merchants now pay for clean commercial coffee is 11d. to 1s. per lb., so that, after paying for picking and all other expenses, the margin left is ample to give a very handsome profit to the planter.

In putting the coffee on the Queensland market it is by no means necessary to send it in as fully cured and cleaned commercial coffee. Hulling machinery can be dispensed with; so far as the planter is concerned, it is parchment-cured coffee that is required.† That proper curing (drying) is absolutely necessary to produce the best quality of coffee, will be admitted without question. Lord Brassey, in an interesting visit to a large coffee estate near Rio, says in "Voyages and Travels," vol. i., page 92, that by drying the coffee on concrete barbecues instead of on earthern floors (as was formerly the custom) the quality had improved, and Brazilian coffee rose from 10s. to 21s. an arroba (32 lb.). But to come nearer home: Two sample parcels of Queensland coffee have been unfavourably reported on by London experts, owing to the curing not being up to the mark; the remedy is in our own hands, but the subject of proper curing will not enter into the present communication—suffice it to say, no elaborate artificial heating plant or expensive barbecues are required. A substitute can be had which is adapted to modern requirements for properly sun-drying the coffee, and in its working is effective, economical in cost, and labour saving. Probably few are aware of the great quantity of coffee likely to be produced from an area of 50 acres containing 1,000 trees to the acre. A full crop over such an estate may be put down at an average of 2 lb. parchment-cured coffee per tree, or nearly 45 tons. If sold at $8\frac{1}{2}$d. per lb., 100,000 lb. would give over £3,540. A comparatively small capital is required in coffee cultivation, but with good management, combined with proper plant and other requisites, no other industry has attractions equal to it. The Minister for Agriculture and other heads of the Department deserve every credit for being so fully alive to the possibilities—or rather certainties—attached to the extension of coffee-growing. The State nurseries and individual planters have practically shown the growth of the tree from a seed to its full bearing capacity. The growth of the plant in Australia gives new experience, owing to its adaptability to soils and climate, to which, in the previous history of the tree, no parallel can be shown. Queensland should, therefore, without delay take its proper place as a coffee-growing country. With the labour of school children and other white labour required during the crop season, it would appear that we can now and will be in the future quite independent of coloured labour.

The early maturity of the coffee-tree in Queensland does not necessarily mean a short life, as there exist many trees in the neighbourhood of Brisbane over thirty years of age and still bearing. In the city itself the Botanic Gardens possess a fine cluster of coffee-trees which the records show were planted a quarter of a century ago. These trees exhibit no appearance of

* Mr. Cowley states that a white labourer in a day of ten hours picked 90 lb. of ripe berries. With a full crop in the first picking a maximum of about 140 lb. might be expected by a youth with sharp eyes and nimble fingers.

† In cleaning the coffee the loss in weight is 25 per cent. or less; but the loss in bulk is about one-half in Queensland. Two bags of parchment cured will equal in bulk one bag of commercial coffee-beans.

decay or disease, and annually produce good crops. They have had little attention and still less pruning. Queensland experience shows that the pruning knife should be sparingly used.

The curing of the coffee will now be dealt with. This is of primary importance. Care should be taken to prevent any mal-odour in or near the surroundings. Tanks, drying-ground, and trays should be non-absorbent of moisture; the pulper should rest on a concrete floor; the tanks when not of concrete should be made of galvanised iron—ordinary iron will rust. The coffee bean is at all times susceptible to anything deleterious, and this is more marked in the early stages of the curing process.

Australian coffee may be hyper-sensitive, but with up-to-date plant and proper care the aroma and keeping qualities of the bean will be improved. Primitive methods of curing will not do; growers must grasp these facts in order to obtain the full measure of commercial success.

In a recent official report issued by the Agricultural Department, the advice is given regarding an intended shipment of coffee to London:—"That it be sent in some vessel where it will be guaranteed a passage away from any contaminating smell, such as hides, wool, or tallow, as the coffee bean is most apt to acquire any untoward odour."

Buildings and Plant.—Growers expecting a crop next year, 1898, should without delay see to their requirements. Let it be understood that in the following specifications the requirements of a full crop are in view, but for a first crop only about one-third of the superficial area of buildings, &c., or capacity of tanks is required. The pulper, however, should be of full capacity from the start. Official reports give 4 lb. of ripe berries per tree at first crop, and 11 lb. in the second or full crop.

Let us assume that the first crop averages 3 lb. of ripe berries per tree, and the second crop 9 lb., averaging each pound of berries to give 22 per cent. of parchment-cured coffee beans, or at the rate of 17½ per cent. when fully cleaned. The result is—

1st crop—third year—3 lb. berries giving			10½ oz. parchment or	8·4 oz. clean	
2nd "	fourth "	9 lb. " "	31½ oz. "	25·2 oz.	"

The picking season will last about three months or so. About one-half of the crop will be taken off in the first month, or, say, in twenty-five working days. Assuming the maximum number of trees to each acre is 1,000 (43½ square feet to each tree), the second crop yielding 9,000 lb. of berries, or an average daily picking during the first twenty-five days of 180 lb. of berries per acre: two days' picking, 360 lb.

Pulper.—The capacity of the pulper on any estate should be equal to a maximum two days' picking of a full crop, and to put that quantity through in two hours or less. The pulping will usually be done daily, but accident or other causes may interfere, and a day's pulping may be lost.

Two days' picking on	5 acres gives	1,800 lb.,	pulper capacity	1,000 lb.	per hour
" "	20 "	7,200 lb.	"	3,600 lb.	"
" "	50 "	18,000 lb.	"	9,000 lb.	"

If the pulping is done in the evening, on the morning following the coffee is washed and put out to dry.

The *Pulping-house* may have a store for the cured coffee and other requisites, under the same roof, or otherwise, as found desirable.

Washing-tanks.—These should be made of a shallower depth than usual. One receiving-tank and one washing-tank, each to hold 100 gallons, are wanted for the first crop on a 5-acre estate. The number and capacity to be proportionately increased to meet a full crop, viz.:—

For 5 acres—total combined capacity of tanks ...	...	600 gallons
" 20 " " " " " ...	...	2,400 "
" 50 " " " " " ...	...	6,000 "

Barbecues.—The clear area of drying-ground should be equal to three days' picking at least.

On an average there will be two dryings every week—3½ days each.

Three days' picking will give as follows:—

5	acres—2,700 lb. berries,	at 52 %,	give	1,400 lb. pulped;	area,	360 sq. ft.
20	„ 10,800	„	„	5,600	„	„	1,440 „
50	„ 27,000	„	„	14,000	„	„	3,600 „

A bushel of coffee spread 1 inch deep covers 15½ square feet.

Sheds.—These should be erected to the south of the drying-ground, to receive the coffee at night or during rain, and have sufficient flooring-space to prevent heating. For 5 acres—240 square feet, and so on, in relative proportion.

Motive Power.—Unless there are good reasons for adopting some other power, whether the supply of water be ample or moderate, the horse-geared attachment has many advantages. It is cheap, clean, and simple, and it has to be borne in mind the short time the pulper is in use daily for a few months of the year only.

Trays, &c.—The writer has patented an improved rake, manipulated to give entire satisfaction. It can be adapted for use on the barbecues; but where these do not exist, portable galvanised iron trays, specially constructed, are substituted for the barbecues. The coffee is kept at an even level, and the raking thoroughly aerates every bean, which quickens the drying—an important point. The triage loss by overcured and burnt coffee is practically nil. In sudden change of weather, the trays with contents are quickly got under cover, and the shed accommodation is reduced to about one-third. It is almost unnecessary to add that the trays with rakes, &c, do not cost one-half of the amount required to be expended upon properly finished barbecues with their low dividing-walls, channelling, &c., &c.

West African Oil Palm.

(*ELÆIS GUINEENSIS.*)

BY E. COWLEY,
Manager, Kamerunga State Nursery, Cairns.

THE production of oil for Australian necessities has long been a source of anxiety to economists on this continent. Excepting in adjacent New Zealand, no stores of mineral oil seem to have been discovered. It is true, Australasia contributes, with her immense herds, large quantities of tallow. South Australia seems to have taken the initiative in producing olive oil; the product is well spoken of. New South Wales has erected a mill for the extraction of cocoanut oil, and, if report speaks truly, the supply of copra is not equal to the demand, even for this one mill. The markets for the South Sea Island supply have been found in Europe for many years past, and doubtless it is somewhat difficult to divert the stream into Australian ports.

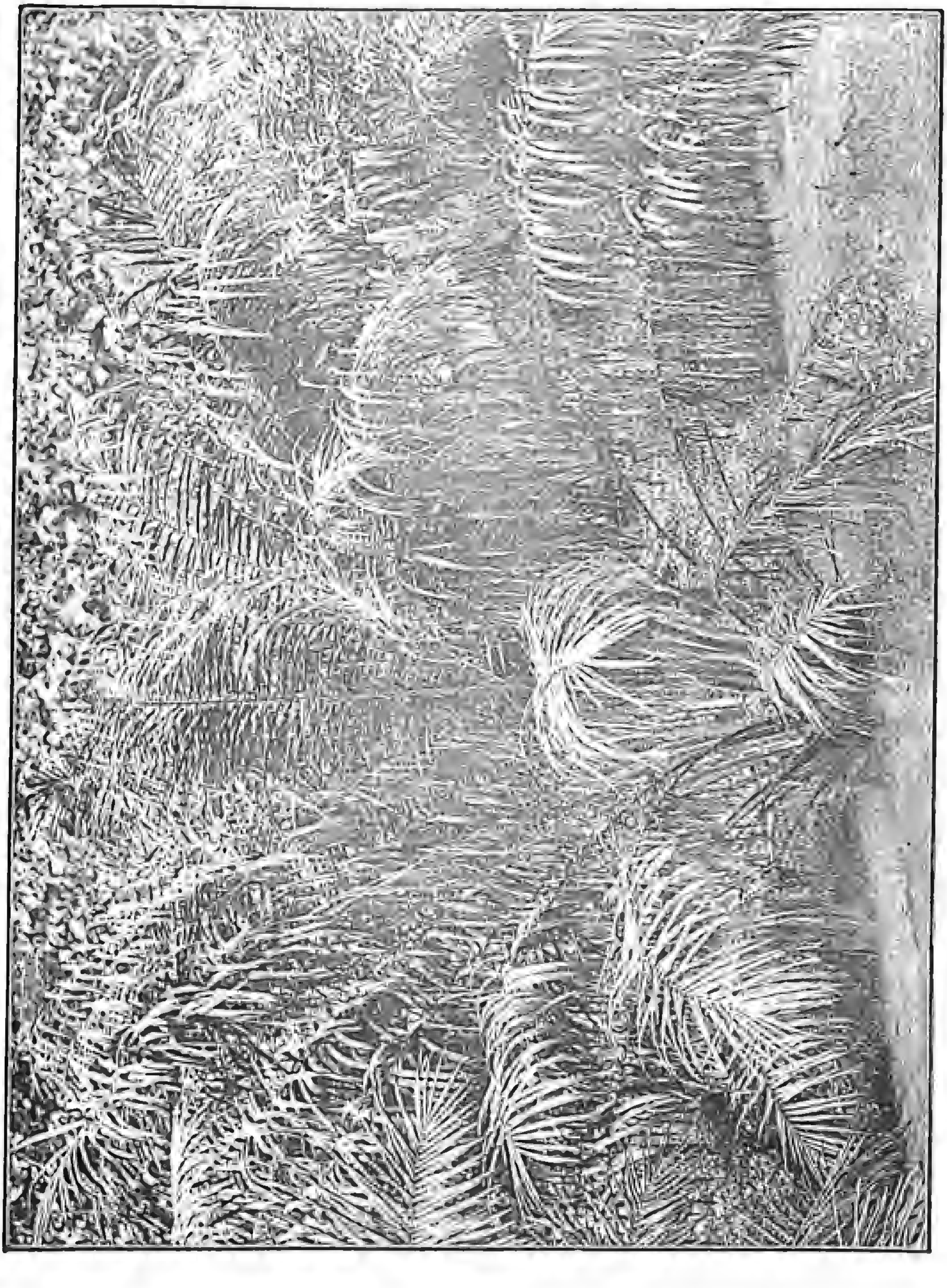
Cochin cocoanut oil was quoted, 6th August, in the *Produce World*, at £27 to £28 per ton; Ceylon, £23 to £24*; while palm oil, Lagos, was £24. The great question is, Can Queensland produce vegetable oils at such a price that the cultivation of the oil-producing palms will pay the grower? The case of cocoanut-growing will be considered in a later article. At present the subject will be the oil palm. This palm is apparently a native of Guinea.

The name "elæis" is from *elaia*, the olive; similarity of expressing oil from the fruit. Natural order, palms. The best kind of palm wine is from this palm. Palm oil, so much used in the manufacture of soap and candles, is chiefly the produce of this palm. The oil palm of western tropical Africa; height up to 40 feet, foliage superb; the leaves occasionally reaching 15 feet. A well-developed cluster of fruit spike may attain a weight of 40 lb., and on it upwards of 800 fruits may be counted, each the size of a walnut. The outer portion of the fruit, almost of lard-like consistence, through boiling yields the commercial oil for soap or candle manufacture. This palm likes a coast climate. At Port Curtis it ripens fruit.—*Edgar.*

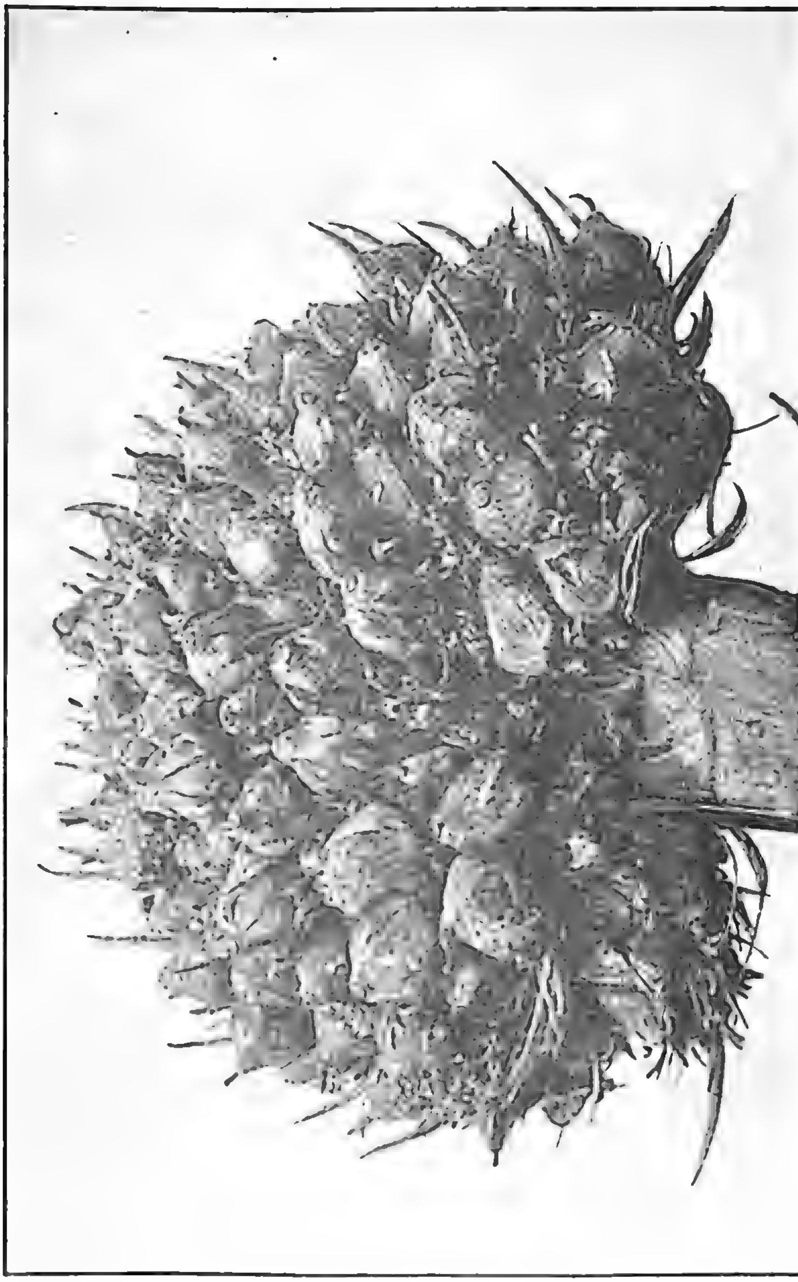
The import of the fat-like oil of this palm into Britain during 1860 was 804,326 cwt., valued at £1,786,895; during 1886 it was 1,004,419 cwt., valued at £1,050,459.—*Mueller.*

During September, 1890, the Department of Agriculture introduced from Sierra Leone twenty plants of *Elæis guineensis* for their State Nursery, Kamerunga. These plants doubtless suffered from the long sea voyage and transhipments. Eight, however, survived, and now, having thriven, form no mean object of attraction to the nursery. Two fruiting spadices appeared for the first time during last year (1896), but the nuts are not fertile. This year (1897) some thirty clusters of fruit are disposed on the eight trees. The individual nuts weigh about half-an-ounce each. The entire spadix weighing 5 lb., this gives about 160 nuts to the bunch. The trees have been planted in a light, free, loamy soil, with abundant subterranean drainage, and have had to suffer considerable dryness of atmosphere for a lengthened period. The leaves, which are numerous and beautiful, have attained a length of over 15 feet. Indications of a stem being started are present. Male flowers are in evidence on most of the palms, so it is most probable the nuts will be fertile this year. It would be interesting to learn if Mr. Edgar, of Rockhampton, has succeeded in germinating any seeds from his plants. The

* The *Ceylon Observer* of September, 1897, quotes Cochin cocoanut oil at £29 per ton.—Ed. *Q.A.J.*



WEST AFRICAN OIL PALM (*ELÆIS GUINEENSIS*).



FRUITING-HEAD OF WEST AFRICAN OIL PALM.

nuts of the Kamerunga specimens are not densely covered with the oil-yielding substance. The shell of the nut is very hard, and resists a smart blow from a hammer; it is about a quarter of an inch in thickness, or quite as thick as an average cocoanut shell; its small diameter makes its resisting strength very great. The kernel is white, somewhat hard and dry, and is tasteless. Notwithstanding this, it has a considerable value in the European markets. In all probability *Elæis guineensis* requires a damp soil and moist atmosphere. It does not seem to have been cultivated for commercial purposes in Ceylon, or in any of the West Indian Islands. Its range, according to Simmons, appears to extend from the coast of Guinea to the south of Fernando Po, and grows as far up in the interior as *Zheru*, a distance of 400 miles from the sea, on the mouth of the Miu, one of the embouchures of the Niger. Captain Burton states that this palm is known by the Arabs to grow in the islands of Zanzibar and Pecuba, and more rarely in the mountains of Uragona. It springs up apparently uncultivated in large dark groves on the shores of the Lake Tanganyika, where it hugs the margin, rarely growing any distance inland. This fine palm, he adds, is also tapped, as the date-palm is in Western India for toddy.

The process of extracting the oil is simple. The clusters or branches of fruit, which contain perhaps as many as 4,000, are gathered by the men, and thrown indiscriminately into a trench or pit, and are left until they become somewhat decayed. The fruit is afterwards pounded in a mortar to loosen the husky fibre covering the nut. This done, they are placed in large clay vats filled with water, and two or three women tread out the semi-liquid oil, which comes to the surface as disengaged from the fibre, when it is collected and boiled to get rid of the water. The inner surface of these clay vats, having at first absorbed a small quantity of oil, is not afterwards affected either by the water or the oil. (Simmons). M. Boussingalt has shown (" Economie Rurale ") that the average production of oil from palms is at the rate of 200 kilos* per hectare—that is to say, superior by a third to the production of oil from the olive in the South of Europe.

Since the year 1871, the quantity of palm oil imported into the United Kingdom has declined; probably the decline in value has something to do with the exportation. The price of palm oil, as quoted by Simmons for 1876, was £41 per ton. The *Produce World*, in its August (1897) issue, gives the price as £24 per ton.

The London Chamber of Commerce *Journal* has the following:—"The staples in trade in the Benin River are palm oil and palm kernels. From 1872 to 1881 trade was stopped in kernels. The stoppage was associated with the death of an old king of Benin, from which the people were led to believe that if they allowed the kernel trade their 'big men' would die. The main reason which influenced the situation was to keep down the rising generation, and to 'ring' slavery and the trade advantages derived therefrom. The busy season is from April to July; the remaining months represent the slack season. A curious fact is that on the Benin side of the river—that is, the right bank—soft oil is the staple; while on the left bank and eastward, hard oil is obtained." Governor Moloney goes on to explain that the difference of manufacture is that one (the hard oil) is the result of the cold process, while soft oil is the result of the boiling process. Palm oil is received in barter, by the cask, each cask holding about two-thirds of a ton, or from 220 to 240 gallons. Hard oil is not acceptable in the German market; it has to be sold in England. The soft oil is said to be as good, if not the same, as Lagos oil, yet it rarely commands the same price. Kernels are bought by cask measure of half a ton each, used for the purpose. The nuts are cracked, the kernels producing a fair white oil. No mention is anywhere made as to how the nuts are cracked, but doubtless this involves serious amount of labour. In the Kamerunga specimens, the bunches of fruit are compressed

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* 1 kilo = 2¼ lb. 1 hectare = 2½ acres nearly.

inward towards the centre by the leaves, and considerable difficulty is experienced in dislodging the spadix from the parent tree, the enveloping base of the leaf having to be removed before the nuts are free. From pictorial evidence obtained from a dictionary (Ogilvie and Annandale) it would seem that the adult tree retains the old leaf bases and gives the palm a rough appearance, but in the earlier stages a more graceful picture of vegetation could hardly be imagined; probably the same beauty would last for fifteen or twenty years. The following may be of interest:—The kernels, with the exception of an insignificant quantity used for the manufacture of oil for domestic purposes, in Africa were formerly thrown away. Attention was first drawn to their utilisation in Liberia. Within the last fifteen years they have been more generally collected and employed. The shell being broken, the kernels are shipped to be pressed for oil, &c. Vast extension of the African trade has arisen out of this new export. It has been estimated by competent authorities that from the 50,000 tons of palm oil shipped, there must be 10,000,000 bushels of kernels, equal to 223,000 tons in weight. The average yield from these kernels being about 30 per cent., if all were utilised, this would furnish 76,000 tons more of oil, worth, at the price of cocoanut oil (which it closely resembles), about £2,700,000. The oil cake is valued at £6 per ton. In Liberia, on a small scale, a bushel of kernels was found to yield two gallons of oil, but with good presses a very much larger yield than this is obtained. The palm kernels are quoted in London, 1877, at £12 10s. to £14 per ton. The size of the kernels varies from that of a hazelnut to that of a small pigeon-egg. They are very hard, nearly inodorous, rather insipid to the taste, and extremely rich in fatty matter, possessing the consistency of butter, with the useful property of not readily turning rancid. The value of the kernels seems to be even greater than the value of the oil from the material of the surface. That shipped from the port of Lagos averages nearly £300,000, or double that of palm oil. It would be interesting to know how the natives of Africa rid the kernels of the enveloping shell.* The nuts vary in size, according to the position each individual one grows on the spadix, and it would appear from this that a sizer would be required before the nuts could be put through a nutcracker and the kernels secured. Judging from a distance, it is hard to know how the operation is carried on. Presumably labour is not of much value on the West Coast of Africa, and the vast hordes, which were at one time liable to slavery, are even now abjectly submissive to their kings or chiefs.

Machinery to manipulate the nuts and preserve the kernels has probably been introduced, although no mention is made by any of the authorities that have been consulted by the writer.† In a volume of the *Tropical Agriculturist* for 1888 and 1889, we are told that African palm-oil nuts are becoming quite plentiful in many districts in Ceylon, and the question will speedily arise as to how they are to be utilised, either for export as plucked or by having the oil locally expressed; and that the British Consul at Loanda, in a recent report on the agriculture of the province of Angola, describes the method of

* A paper by Mons. Max Astrie, M.G.S., translated by Major A. J. Boyd, was read at the last meeting of the Australasian Association for the Advancement of Science, held in Brisbane in 1895. The paper was entitled "A Voyage to Kagnabak Island, Bissagos Archipelago, Portuguese Guinea, N.W. Africa." The writer stated that the whole of Anhoumero Island is covered with palm-trees (not to be confounded with its congener in Africa, the date palm). The oil palm-tree of the Bissagos is a tree about 8 to 12 metres (25 to 38 feet) high, at the head of which bunches of spadices are produced, growing to the size of a man's head. On each spadix are hundreds of small nuts covered with a fleshy red skin. The natives gather the nuts, and throw them into a vessel of boiling water. The skin throws off a quantity of oil of a brick-red colour. This is the palm oil. When the nuts have been deprived of their skin, they are set aside to be broken up with hammers by women and children, who extract from it a hard oleaginous kernel, well known in all the markets of Europe under the name of palm kernels.—Ed. *Q.A.J.*

† M. Olivier, Viscount of Sanderval, M.G.S. of Marseilles, invented a machine for breaking the palm nuts and easily extracting the kernels. But the Bissago natives are so ignorant and brutalised that it has been found impossible to induce them to make use of this ingenious apparatus, which in one hour will perform an amount of work which would employ a man working with a hammer for fifteen days.—Ed. *Q.A.J.*

obtaining palm oil, the great staple of trade along the rivers of West Equatorial Africa. The palm from which the oil is obtained may be said to be a wild product of those regions, and requires no planting. Yet it receives a certain amount of attention at the hands of the natives in the shape of pruning, lopping off dead and dying leaves, and tapping some of the larger leaves, with the object generally, it is presumed, of improving the fruit. The latter grows in large clusters, nearly pear-shaped, or somewhat like a huge branch of very bright-red grapes,* some clusters counting, perhaps, a thousand nuts which are partially embedded in a kind of fibrous matting. The nuts and fruit are the size of and nearly the shape of a pigeon's egg, of a bright-red colour, tinged sometimes with yellow and in some cases deepening in shade almost to black. The nut is composed of three parts: the outer covering is from ⅛-inch to ¼-inch in thickness of a fibrous nature, and in this is the oil. The inner nut is cracked, and the kernel, which produces a fine white oil, is sold. The *Agriculturist* goes on to say, "This African palm grows so readily in Ceylon that it may come to rival the cocoanut and palmyra—indeed, exceed both in its ready growth."

William Brothers, of Heneratgoda, Ceylon, offer seed of *Elæis guineensis* for 10s. per 100. A spadix of the fruit of *Elæis guineensis* has been sent from the Kamerunga State Nursery to the Departmental Museum for inspection by the public. The palm and the spadix are illustrated in this issue of the *Journal.*

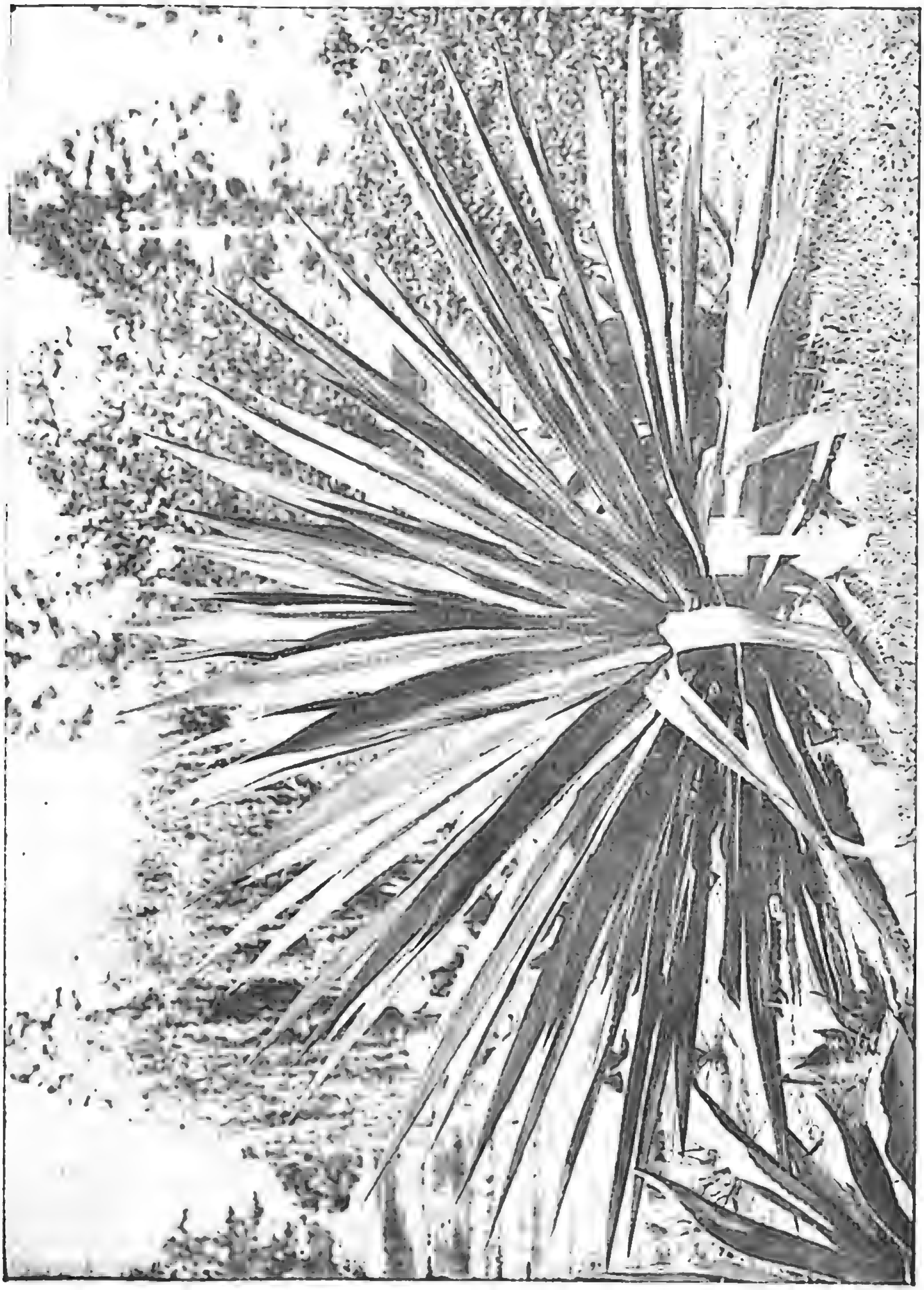
* A bunch of oil palm nuts is persistent and spiny, not pendulous.

Sisal Hemp (Agave rigida).

In our last article on the subject of Sisal Hemp, several varieties of the plant were described. Four especially were noted as producing the sisal hemp of commerce, viz.:—

1. *Agave rigida*, var. *elongata*;
2. „ „ „ *sisalana*;
3. „ *Heteracantha*.

The fourth is not really an *Agave*. It is grown in Mauritius, where it is known as the Green Aloe (*Fourcræa gigantea*). This plant is found in abundance in various parts of Queensland. Its fibre is of great commercial value, but not so great as that of the true *Agave sisalana*. To the ordinary eye there seems little difference between the two plants, but this may be seen by placing two plants or leaves together. Our illustration shows the former plant taken from specimens growing in the Brisbane Botanic Gardens. Any person having the intention of trying its cultivation should not plant indiscriminately whatever *Agave* he can pick up in his district, but should apply for plants to the Department of Agriculture, and submit any other plants he may propose growing, to the Government Botanist.



MAURITIUS HEMP (*FURCRAEA GIGANTEA*).

The Rubber Industry.

Mr. E. Cowley, manager of the Kamerunga State Nursery, has reported to the Under Secretary for Agriculture that seeds of rubber-trees grown in the nursery have germinated freely. The seeds of the Ceara rubber-tree (*Manihot Glaziovii*), obtained from the trees sown in August, 1897, have germinated. This interesting fact would seem to preclude the necessity of importing cuttings from Mourilyan or elsewhere. It has hitherto been considered that twelve months* would elapse before seeds of *Manihot Glaziovii*, planted naturally, would grow. It would seem, from what Mr. J. Medley Wood, of Natal, says, that plants obtained from cuttings yield abundance of seed. This has not been yet demonstrated at the Kamerunga Nursery, as no cutting-produced tree is old enough to bear seed. Perhaps the fact that Queensland-produced *Manihot Glaziovii* seeds germinate within three months from time of planting, under somewhat untoward seasonable circumstances, may be of value to intending rubber-planters. It would appear that each rubber-tree of this variety will yield at least 100 seeds when it is four years old—perhaps even more, and possibly somewhat earlier.

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* *See* article on India-rubber—*Queensland Agricultural Journal,* Part 2, p. 138.

Camphor.

The White Camphor of commerce is obtained from the *Cinnamomum camphora* by sublimation of the leaves and wood. This is also called Formosa and Japanese camphor. It is the most important as being the commercial form of camphor. A decoction is made from the root, wood, and leaves of the tree which is also called the Camphor Laurel. Next in importance comes the Barus camphor (from Barus, a town in Sumatra), also known as Kapur Barus, Borneo, and Malay camphor. The product is obtained as coarse crystals formed entirely in the stems of the *Dryobalanops camphora*, Colebr. *Dryobalanops aromatica*, Gaertn., is a tree closely allied to the Indian Sal, and therefore a member of the natural order Dipterocarpæ. It is found in British Sumatra, and the natives cut it up into small pieces to find the crystals of camphor. The crystals found exist in concrete masses, and occupy longitudinal cavities in the heart of the tree from 1 foot to 1½ feet long. The old trees are generally the most productive, and an average tree is said to produce 11 lb. weight. The camphor is also found underneath the bark of the *Dryobalanops aromatica*. A more or less quantity of essential oil is also found in the cavities of the wood. The value of the produce of the *D. camphora* is 80 rupees per lb., whilst the ordinary kind imported from China is worth only from 40 to 65 rupees. As much as 5 gallons of oil called Borneene is often taken from one tree.

The camphor oil of Formosa is quite different. It is a brown oil, which drains from the cases containing crude camphor. It smells like sassafras, and from this so-called oil, or rather solution, camphor is precipitated when the temperature of the liquid falls.

The camphor-trees, so many of which grace our gardens, parks, and streets, are *Cinnamomum camphora*, and are very easily grown, as they adapt themselves to most soils and climates.

Entomology.

INSECT FRIENDS AND INSECT FOES.

[Read at the Conference of Australasian Fruitgrowers—Brisbane, June, 1897.]

By HENRY TRYON,

Government Entomologist.

The importance of studying the relations that subsist between insects and plants that are the objects of the fruitgrowers' care, and between one class and another in so far also as they affect his interest, is so obvious that it would but insult the intelligence of those present were any attempt made to specially urge the claims of such a subject—as may be deemed to be embraced in the title of this paper—on your consideration.

Insect Foes.

With regard to those insects that may be defined by the term "foes," it may be remarked that it is proposed to treat the subject in a general manner without special reference to any particular plant-pest, since the able Government Entomologist of Victoria (Mr. C. French) has graciously offered to address you on this topic, and it would not become the writer, even were he disposed to do so, to endeavour to anticipate any of the important discoveries that doubtless so competent an investigator has to announce.

Prompt Measures—Rate of Increase of Insects.—The apparently sudden appearance of an insect pest in a place where its presence has never previously been remarked and its speedy dissemination through a district, are occurrences not infrequently met with. The explanation of the phenomena, however, is seldom forthcoming; and yet it resides to a great extent in facts pertaining to the insect itself and its develoment. The case of the Aphis is significant in this connection. Charles Bonnet* has informed us that, with a particular species under his observation, single females produce generally each 90 young ones; at the second generation these 90 produce 8,100; these give a third generation that amounts to 729,000 insects; these in their turn become 65,610,000; the fifth generation, consisting of 590,490,000, will yield a progeny of 53,140,106,000; at the seventh we shall thus have 4,782,789,000,000, and the eighth will give 441,461,010,000,000. This immense number increases innumerably when there are eleven generations in the course of the year. Moreover, as the writer has elsewhere observed, "the rapidity with which generation succeeds generation, may be inferred from the fact that on examining a viviparous female not only can one see within it the young unborn insects, but even within the latter themselves the members of a succeeding generation." †

The fecundity of the Aphis is, however, exceptional; but still there is a high rate of increase in other insects also. Amongst Scale Insects, perhaps, there is none that has ever created such general interest as has the San José or Pernicious Scale (*Aspidiotus perniciosus*), an interest in which many of the fruitgrowers of the Australian colonies have amongst others participated. In New Jersey, U.S.A., where its reproduction is necessarily restricted to the summer months, the female insect becomes adult in about thirty days; reproduction then ensues, during which from 480 to 500 young are born. But before it has ceased to reproduce, its progeny has commenced also to multiply. Thus nearly five full broods arise in the course of the season, and so the descendants of a single female may reach the enormous figure of 1,608,040,200.‡

As a further instance may be taken the Boll Worm (*Aletia argillacea*, Hubnr.) of the cotton plant, of which the female lays 500 eggs. In its case, according to E. A. Schwarz, there may be seven, and are probably more, generations in a season.

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* Traité d'Insectologie, ou Observations sur les Pucerons, pp. 28-38. Paris, 1745.

† "Insect and Fungus Pests," p. 85. Brisbane, 1889.

‡ J. B. Smith. Report of Ent. Dep. 1896, Agr. Col. Exp. Stat. New Jersey, pp. 542-3. 1897.

Again in the case of an insect, allied to one of our destructive western plant-bugs, the Chinch Bug (*Blissus leucopterus*, Say.), S. A. Forbes, of Illinois, has stated that "a single female has the capacity of giving origin during a single season, if all things are favourable, to about 90,000 progeny."

These facts point to the paramount importance of the following procedures on the part of the fruitgrower:—

1. If practicable, he should not permit the bringing of a single plant on to his land—whether it be fruit-tree, ornamental or flowering shrub, &c.—without submitting it to a very close scrutiny, with a view to discovering whether it harbour insect pest or not. This will involve removing all the soil from its roots by aid of a brush and water. Moreover, even if apparently clean, he should immerse every such plant for at least ten minutes in water containing an insecticide.*

2. The discovery of even one or two Scale Insects, or indeed of any insect that he has grounds for regarding as pernicious, upon the trees or bushes in his garden or orchard should be the occasion for the commencement of measures of repression; and the expenditure of a few hours now and then in work of inspection with lense in hand, especially in a newly-planted orchard, will be time well spent, as after-events may demonstrate. Should any insect new to his experience be discovered, it might be profitable for him to seek the advice of a trained entomologist before attempting to deal with it.

A very large proportion of the destructive insects that the orchardist is called upon to contend against, are not native species; and it will generally happen then that, if he does not himself bring them on to his own land, or is not beholden for their presence to the vicinity of unclean trees the property of others, his cultivation will remain free from them. And this consideration, together with a knowledge of the rate of insect increase, should justify the adoption of the course recommended for adoption.

Seasonable Measures.—Those of you who may be unhappily called upon to deal with the Codlin Moth, are aware to what extent the success of their operations—especially when resort is had to the use of Paris green—will depend on applying this reagent at the correct time. Fruitgrowers in Australia do not, however, appear to be equally persuaded that it is also to their advantage to apply the appropriate remedies at certain definite times when contending with other pests.

Thus, (1) in the case of insects that manifest several successive broods during a portion of the year, measures should be resorted to on their first appearance, although it may be a matter of comment that such-and-such a pest "does not seem to be bad this season," or that "we have none [*i.e.*, comparatively none, H.T.] of this or that destructive insect with us as yet."

Again, (2) all insects, wherever practicable, should be attacked before they have laid their eggs—a matter to be ascertained by actual investigation. When once they have accomplished this act, and thus taken steps to ensure their preparation, they will soon die without man's intervention.

Thus, too, (3) insecticides should be used when the insect against which they are being employed, are the most vulnerable or capable of being injured. For instance, Plant-bugs (*Hemiptera* and *Homoptera*) or Grasshoppers should be assailed when their wings are as yet undeveloped and their unprotected bodies have a soft consistency. So also similarly with Scale Insects. When the eggs of these redoubtable pests are protected as they lie beneath the hard scale of the parent, in which position they may rest for a period of at least two months, the application of insecticides, other than those consisting in fumigation, is not as a rule successful. It will be otherwise, however, when their tiny but numerous progeny are crawling about or have but recently settled down. Further operations, having for their end the prevention or repression of insect injury, should be regarded as ordinarily cultural operations, and should not be intermitted or suspended when still called for. The gathering of the crop, instead of being made to mark the season for their discontinuance, is often the proper occasion for their employment. Chance and overlooked fruit that is said to be "not worth troubling about," may serve to perpetuate the existence of a deleterious insect; so also may plant *débris* and general orchard refuse. An apt illustration of this is afforded by agricultural procedure in Queensland so far as it relates to maize. The field is made to subserve the purpose of a barn, with the result that grain becomes affected with weevils to an extent proportionate to the time it is left in the field. Again, even when the cobs are removed, the maize stalks are still left standing, with the result that all the Stem-borers that they may contain are enabled to develop into moths and so augment the numbers in which these deleterious pests occur.

* Little's soluble Phenyl at the rate of 1 gallon for every 50 gallons of water, or carbolic acid crystals 2½ lb. to every 50 gallons of water, or kerosene emulsion wash, 1 in 9, are suitable for the purpose indicated.

Treatment of the Soil.—The observation of plant life reveals the fact that trees already established readily respond to temporary changes of environment, whether these changes are related to the condition of the soil that their roots traverse or to that of the air in which they extend their branches. But it is no less true that whatever insects are intimately connected with these plants—*e.g.*, as may be Scale Insects should they occur upon them—they are affected by these changes of environment also. In fact, the alterations that these Scale Insects undergo are more often than not, the first indication of anything abnormal in the tree. Thus it was observed in many parts of California in May, 1896, that the previously mentioned Pernicious Scale (*Aspidiotus perniciosus*) experienced a remarkable natural mortality that could not be explained by the occurrence of any parasitic organism. This mortality, that was not attended by any special meteorological conditions, seemed to indicate the occurrence of some general abnormal change in the plants that supported them. And, again, with regard to the same Scale Insect, it has been observed that its northern limit of distribution in the United States of America, does not depend on the existence of any unsuitable conditions of climate, but seems to be determined by the fact that a special red shale is the prevalent rock, and that this forms a barrier to its progeny. Now, this geological feature can only act in this manner through the medium of the plants that grow in it, and support the Scale Insect in question.*

We trace again the same influence in cases in which generous cultivation of the trees of an orchard has induced in them a vigorous condition of growth, that seems to react on the Scale Insects, for these—under such circumstance—many often cease to multiply and even commence to die out, whereas, on the other hand, neglect, whilst it prejudiciously affects the trees, brings renewed potency to the insects.

This interaction of insect and plant and the manner in which it is displayed suggests, (1) the desirability of maintaining in the orchard good cultivation, using that term in its most generous interpretation, as a powerful auxiliary in dealing with certain insect pests, such as Scale Insects. It also (2) points to the probability of its being found possible to deal with a certain class of insect pests that are closely associated with their host plants, as are Scale Insects, by special treatment of the trees, consisting in administering to the soil certain chemical substances calculated to determine the existence of changes in them.

With these general considerations relating to that division of the subject "Insect Foes" concluded, it may be permitted to the writer to proceed to treat of "Insect Friends."

INSECT FRIENDS.

Beneficial insects from the fruitgrower's point of view may be grouped into two classes, viz.:—

(1) Comprising those that are directly useful, and such as those that secure the pollenisation and cross-fertilisation of flowers and consequent setting of fruit.

(2) Comprising those that are indirectly so—*e.g.*, insects that prey upon deleterious members of their class, or are parasitic on or within them.

CLASS I.—The importance to the fruitgrowers of those insects that convey pollen from one flower to the other cannot be overestimated. Nature, as has been remarked, "abhors self-fertilisation," and cross-fertilisation that is so desirable, is largely effected by insects. On the success of this act of cross-fertilisation depends, as you are aware, the setting of the fruit that would otherwise often drop to the ground prematurely when but just formed.

Very various are the insects that are included in this class, that embraces both those that feed upon pollen exclusively and those that consume nectar. Usually, however, the important rôle that they enact results from the circumstance that this fructifying element adheres to their bodies, and especially to the curious serrated, branched, or plumose hairs with which these are clothed. In others, it becomes attached to their often remarkably formed tongues, and is conveyed from flower to flower, whilst these organs are used in exploring one after another for honey. Hive-bees are often regarded almost exclusively as flower fertilisers; but the class even includes Butterflies, Moths, and Beetles (Cetonias, Small Scarabæids, Buprestidæ, Soldier Beetles, Malacoderms, Cleridæ, &c.). Flies are especially serviceable. So are the "native bees" (*Trigoria*); the many solitary Apidæ, the short-tongued bees (Andrenidæ), and even the social wasps—*Polistes*, for example.

Australia is richly endowed with beneficial insects of this class; but, notwithstanding this, it will be almost always to the advantage of the fruitgrower to have

* *Cf.* Dr. J. B. Smith. Report of the Entomological Division, New Jersey Agr. Exp. Stat., 1896, pp. 518-9.

honey bees conveniently near to his orchard, for thereby the partial infertility of his trees will be often avoided. Whilst on this topic, allusion might be made to the useful work accomplished in New Zealand by the Bumble Bees (*Bombus*) in fertilising the red clover.

Class 2 comprises, as has been already stated—(1) Predatory insects or such as immediately prey upon noxious members of their class; and (2) Parasitic insects that deposit their eggs on or within these, that then serve as food for their resulting young. Both predatory and parasitic insects are numerously represented in Australia both by varieties and individuals; and were even typical specimens of those that occur in Queensland to be brought together, the collection would occupy some scores of cabinet-drawers. The Carabidæ, a single predaceous family of one order of insects—viz., beetles—of Australia contained in the collection of the Government Entomologist of Australia, alone fill many large drawers.

Predaceous Insects.—From the foregoing remarks it may be inferred that these are far too numerous to admit of even the principal genera being enumerated, much less described. They embrace representatives of all the different orders. Amongst the Coleoptera are the Tiger Beetles; the Carabidæ; the Flower Beetles, or Cleridæ; the Brenthidæ; the Soft-Winged Beetles (Malacodermidæ); and last, but not least, the Coccinellidæ, or Lady Birds—which, with the exception of the species belonging to the genus *E. pilachna*, are almost exclusively predatory beetles. Caterpillars, ground-feeding grubs, wood-borers, aphids or plant lice, and Scale Insects amongst other pests form the food of this host.

The Hymenoptera is again an order of insects exceedingly rich in predaceous members of this class. One need only mention in illustration: Ants, including the entire family Poneneridæ and the species of the genera *Æcophylla* and *Myrmecia ;* the wingless females of the Mutilliæ and Thynnidæ, the large yellow and black and other coloured Scoliadæ; the large silver and black and other Sphegidæ; the Fly-eating Sand Wasps (Bembecidæ), the Hunting Wasps (Pompilidæ), the Solitary Vespidæ, including the Mason Wasps (*Eumenes*), &c.; the Social Vespidæ, including *Polistes*, &c. All kinds of insect pests fall a prey to these.*

Parasitic Insects.—These that are almost exclusively members of two orders of insects—viz., Coleoptera (Beetles) and Diptera (Two-winged Flies)—are even more numerous than the predatory forms last considered. Almost every plant-eating insect—even the smallest of them—will be found to have at least one parasite associated with it, and some indeed several. The mere description of the different parasitic insects of Australia would alone fill several volumes of letter-press. The Common Soft Scale (*Lecanium hesperidum*) has no less than six different kinds of minute Hymenoptera parasites within it (F. M. Webster); the Red Scale (*Aspidiotus coccineus*) has also a like number (L. O. Howard). Another Soft Scale (*Lecanium Fletcheri*) is also found to have six true parasites. The following facts regarding this insect and its enemies of this description, will illustrate the important part played by parasitic insects:—Four little twigs of *Arbor vitæ* gathered by Dr. James Fletcher, of Ottawa, were found to be infested with no less than eighty specimens of the *Lecanium* in question; but of this eighty, all but five were parasitised, the parasites numbering no less than eighty, and comprising representatives of six different species belonging to five distinct genera of Hymenoptera.† Again, in the case of a single caterpillar, the White Marked Tussock Moth (*Orgyia leucostigma, S. & A.*), that is represented by a co-generic caterpillar pest in Queensland, L. O. Howard has found no less than twenty-one different kinds of true parasites, fifteen of which were Hymenoptera and six Diptera.‡ These illustrations are afforded by occurrences transpiring elsewhere, by reason of the fact that little attention as yet has been given to the subject of insect parasitism in this country; no one, except the present writer, having as yet described any of our parasitic Hymenoptera, though more than one species has, it is true, been figured. "Whenever a plant-feeding species from some cause or from some combination of causes, transcends its normal abundance to any great extent, there is always a great multiplication of its natural enemies, and this multiplication is usually so great as to reduce the species to a point even below its normal. Exceptions to this rule are seen with especially protected species, that through the possession of some distasteful or repugnant quality, have no predatory or parasitic enemies. Even in such cases, disease steps in and fills the want" (L. O. Howard). It may be

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* The writer, in continuation, proceeded to refer to remaining orders of insects—Neuroptera, Hemiptera, Orthoptera, Diptera, and Lepidoptera—mentioning, in the case of each, numerous predaceous insects and the special harmful species which they served to hold in check.—Ed. Proceedings A.F.C.

† L. O. Howard. Some Mixed Results of the Work of the Divis. of Entom., pp. 62-63, 1897.

‡ L. O. Howard. A Study of Parasitism, 1897, p. 7.

inquired what becomes of the parasites themselves when their source of sustenance is almost annihilated as a result of their own multiplication? To this question it may be replied that just as—

Big fleas have little fleas,
And little, less to bite 'em;
And these fleas have other fleas,
And so, *ad infinitum*—

so also of the insects that have been considered: these in turn, have their own parasites, and the latter in turn parasites also. In the "Study of Parasitism" already quoted, the twenty-one parasites of the White Marked Tussock Moth had no less than twenty-five different insects feeding on them, and these twenty-five, no less than ten tertiary parasites living at their expense.

Similarly, some of the predaceous insects feed upon the friendly ones; thus various pollenising insects are devoured by the flower-haunting beetles known as Cleridæ. Similarly, the Robber Flies (Asilidæ) carry off bees amongst other insects. In these two cases, there are instances of predaceous and parasitic insects coming within the category of what were regarded as Insect Foes from the fruitgrower's point of view.

In conclusion, it will be profitable to consider in what degree a knowledge of the facts relating to Insect Foes and Insect Parasitism generally, is of value to the fruit-grower, and to what extent he may expect to profit by discoveries relating thereto. Having learnt, then, that so many insects are beneficial, he might encourage them in two different ways:—1st. By giving them opportunities for multiplying, and generally protecting them. 2nd. By introducing special parasites or predaceous insects from countries or regions in which they exist to others in which they are absent. At the outset, however, it is profitable to reflect that, as a necessary result in the economy of nature, though there may be fluctuations in the relations between the plant-feeder and the predaceous and parasitic species of its own class for any given year, yet, when taking one year with another, these relations remain the same, man's effort availing but little to change the conditions of life to which these different classes of insects are subject; and that the exceptions to this rule, locally brought about as the result of man's work, are very few indeed.

From what has already, in this address, been stated regarding the fecundity of insects, it will be readily understood how, even after the approximate annihilation of any particular species of insect pest, their powers of multiplication being such as they are, the balance between Insect Friends and Insect Foes will be regained with marvellous rapidity: even when efforts are made to co-operate with the latter by assisting in the destruction of the Insect Foes that they also destroy, for these efforts are as a rule when successful only temporarily so and but locally applied.

With regard to the first measure necessary for the encouragement of Insect Foes—viz., their protection and multiplication—it will be necessary for the fruit-grower to be able to recognise Insect Friends, and to distinguish them from Insect Foes as well as from insects whose actions as regards his interests are neutral. At the outset, however, he will be confronted with a difficulty arising from the fact that, as a rule, the most useful insects are minute creatures scarcely discernible. It has been stated by a very high authority in these matters—the late C. V. Riley—that "for the most part the nicer discriminations as to the beneficial species, some of which are microscopically small, must be left to the trained entomologist" (though perhaps but one in a thousand of these is able to distinguish between the primary parasites of small insects and their enemies or hyperparasites—H.T.)

The effort of the fruitgrower will again be further circumscribed by the fact that the majority of friendly insects work unseen, and are only known by what they accomplish. Notwithstanding, he may acquire a knowledge of the means of discriminating some of the larger, especially amongst the predaceous kinds, with little difficulty, and that this knowledge may be of service to him will appear from the following instances:—

1. More than one species of Queensland Wasp collects, and ultimately destroys caterpillars, and will even, with eagerness to obtain its prey, tear through with its jaws, the tissue of leaf-mining kinds, the most difficult of all to contend with. Books relating to British insects inform us that the Wasp is a great fruit-eater. Without observation, the fruitgrower, being familiar with the latter circumstance, would condemn the Queensland *Polistes* equally with the European *Vespa*, and destroy its nest whenever met with. And this is actually what happens in many cases. The following two cases—one relating to the predaceous beetle, *Cryptotæmus montrouzieri;* and the other, to the predaceous moth, *Thalpoçares cocciphaga*—may also be cited in this connection. (*Vid.* Report, pp. 16 and 17.)

Beyond this outcome of his knowledge that will reach him, when to stay his hand in destroying insects, the fruitgrower will seldom be able to put his information regarding the predaceous or parasitic insects to any profitable account. There are a few occasions, however, when this information may serve him, as will appear from the following illustrations:—Queensland, amongst other insect pests, is endowed with a special tree defoliator, a species of case-moth caterpillar, that often makes sad havoc with some of the most esteemed ornamental plants—*e.g.*, the Shea Oaks or Grevilleas, and the members of the genus *Pinus*, especially *P. insignis*. In many cases it is practicable to deal with these insects by hand-picking Now, inasmuch as the female insect is a wingless insect, and cannot therefore travel far, and is moreover very much addicted to having parasites, it is expedient to place all the case-moth caterpillars in the centre of an open field, and so let their parasites effect their escape in order that they may renew their useful work, and not at once destroy them, as should be done generally when other destructive insects are collected.

Again, in spraying for the purpose of destroying Scale Insects, a knowledge of the fact that some examples harbour parasites may be taken advantage of, and so the friendly insect suffered to co-operate. "Let us suppose," to quote F. M. Webster, "that we have 1,000 individuals of some species of Scale Insect, each capable of producing 100 young, so that, if all survived, we should have for a single generation 100,000 individuals; and, further, that we also have 100 parasites (or parasitised scale insects) capable of producing in one generation 10,000 individuals—a ratio as between scale insect and parasite of 10 to 1. Now, if we apply an insecticide and destroy one-half of the Scale Insects, and none of the parasites, we have reduced the ratio of 5 to 1, thus doubling their effective strength." Now it has been found possible to accomplish this in the case of the plum *Lecanium*, by applying the insecticide when the parasites were still beneath the old scales and protected by them, whilst the young unparasitised scales were so thin that the kerosene emulsion, the agent used, penetrated them easily in many cases, " so that while 50 per cent. of the young scale were killed, the parasites were uninjured and appeared in spring in such numbers as to overcome the balance of the young scale that survived. These, in fact, did no injury, then: but for the effect of the parasites, they would in all probability have worked serious damage."*

With regard to the practicability of introducing predaceous or parasitic insects from countries or regions in which they exist, to others in which they are absent, one is again confronted with difficulties, and discriminatory knowledge is again demanded. Introduced insects, as a rule, "show a greater power of increase than do indigenous species, and in a large number of instances have taken the place of the native forms, which have not been able to compete with them in the struggle for existence." Now, unless the predaceous insects or parasite is kept in check in its native home by another insect parasitic upon it, and which will not serve to check its increase in its adopted country, we should expect as an outcome of this increased prolificness that the insects which are useful in subduing insect pests in their native home would, in proportion to to this increased vitality, be less so in the country in which they have been introduced. It is, however, often difficult to introduce beneficial insects without parasites to prey upon them, or so place them, when introduced that they shall be surrounded by congenial circumstances. Moreover, introduced friendly insects may be brought into competition with native ones, not always to the advantage of the latter. The following will illustrate the absence of results that may follow the introduction of imported friendly insects:—A few years ago the able Entomologist of the Hawaiian Government, Albert Koebele, introduced into California no less than sixty species of predaceous and parasitic insects, for the express purpose of coping with the injurious insects of that State, but with the exception of the signal service rendered by *Vedalia cardinalis* and *Novis Kœbelei* in exterminating the Cottony Cushion Scale, "in many thousands of specimens there is not one that can be considered a success at the present time†"; that is according to the testimony of John B. Smith, the well known Entomologist of the New Brunswick Experiment Station, who specially visited California to investigate the subject.

The experience of Australia in the matter of the importations of predaceous and parasitic insects that have already been made, is not altogether encouraging, with the possible exception of that afforded in the introduction of the English Humble Bee to New Zealand. With the object of effecting by this means, the fertilisation of the Red

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* F. M. Webster: Indiana Horticultural Report, 1896.

† John B. Smith, Proc. of the 8th Annual Meeting of the Association of Economic Entomologists, 1896, p. 48.

Clover, in 1874 efforts were made to send over from England to New Zealand certain Aphid parasites to check the alarming increase of these plant pests there (C. V. Riley). Whether they were established or not is uncertain, but if so it may be affirmed that no noticeable results have been attained. Albert Koebele, however, found whilst in Australia the European *Lipolexis rapæ*, Curtis, infesting the cabbage aphis. The present writer has reared from the same pest the *Aphidius brassica* of Marshall, whilst Mr. C. French has figured a parasite whose systematic position cannot be assigned from the material in hand.*

The service rendered to the United States by Australia in furnishing a successful enemy to the Cottony Cushion Scale that attacked their orange groves with such disastrous results was, as stated by the late C. V. Riley, partly repaid by the transmission hither of "some of their predatory Coleoptera and some of the Pacific Coast parasites of the Codlin Moth, and a species of the interesting genus *Raphidia* (Neuroptera) that preys upon the Codlin Moth also." Now, it was announced that Raphidia were received in New Zealand by Mr. Allan White, but nothing further has been heard of these insects or their work.

As a further instance of importation may be mentioned the fact, that some few years since, the New Zealand Government introduced from England to that colony two hymenopterous parasites of the Hessian Fly that had previously become established in its wheat fields. These were *Semiotellus Nigriceps* and *Platygaster Minutus*. The ultimate issue of this experiment is not known, though there can be no doubt but that the insect has become established.†

Although the figure that is given by Mr. T. Kirk in support of his statement is copied from C. V. Riley and not directly from the insect before him, so that there is nothing to show that the latter was not an example of the local one met with by Sir James Hector in 1888.

With regard to further introductions of parasitic and predaceous insects, it were worth while to consider whether it were not expedient to take steps to introduce afresh here certain American destroyers of the Codlin Moth, especially *Pimpla annulipes*, Br., and *Macrocentrus delicatus*, Cresson. To deal with the apple weevil of Victoria and Tasmania (*Conotrachelus nenuphar*), might be imported the hymenopterous parasites *Sigalphus Curculionis*, Fitch, and *Porizon conotracheli*, Riley. In contending with the Mussel Scale of the same fruit the parasite *Aphelinus mytilaspidis*, another American insect, might be introduced. Le Baron locally distributed this some years since with success. Finally, for the destruction of our Pink Wax Scale (*Ceroplastes rubra*, Mast.) we might introduce from the Sandwich Islands two parasites that are reported to check its increase there—viz., the Chalcidid Flies (*Tomocera californica*) and *Coccophagus* sp.—as well as the third species (introduced there) that preys upon a second *Ceroplastes* (*C. floridensis*).

Though a favourable result cannot be anticipated with certainty in the case of importations from distant countries, and especially of insects whose powers of accommodating themselves to altered environment is unknown, it is otherwise when an insect is to be derived from a comparatively approximate region and the insect has already shown its adaptability for becoming "naturalised in a new locality." It would therefore appear that the Scymnid Beetle (*Cryptolæmus montrouzieri*, Mulsomt), whose existence as an Australian insect and whose marked utility as a destroyer of harmful insects was first made known by the writer, might be profitably taken from Queensland to New Zealand in order to reduce to harmless proportions the number of the Mealy Bugs (*Dactylopius adonidum*) that have attacked the vines there with such serious results. The writer, being of this persuasion, has much pleasure in handing to Mr. T. W. Kirk, the Biologist of the New Zealand Government, a number of those useful insects in order that they may be placed under such circumstance as may be conducive to their accomplishing what is expected of them. It must be remembered, however, that *Cryptolæmus* is naturally a sub-tropical insect, occurring, in addition to Eastern Australia, in New Caledonia, Fiji, Ceylon, and Southern China. It will therefore be expected to succeed best in glass houses.

Some intimation of the useful work of this insect is given in a paper by the writer entitled "*Cryptolæmus montrouzieri*, or the Scale Insects' Enemy"; but since this was written thus, the beetle under consideration has been introduced into the Sandwich

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* It must be admitted of this insect, however, that he has figured what would appear to be the above Aphidius, representing it as the parasite of the cabbage moth (*Plucella cruciferarum*), and Mr. T. W. Kirk has copied his apparent error.

† Report of the Government Biologist (*cf.* T. W. Kirk), 1894-5, p. 63.

Islands by Albert Koebele, for the purpose of coping with Mealy Bugs, and other related Scale Insects there. "When I visited Kona," writes an independent witness, "of Hawaii, in 1892, many of the trees were literally festooned with the masses of this pest (*i.e.*, *Pulvinaria*), and appeared on the point of being totally destroyed. In 1894 the Lady Birds were sent there, and very soon had entirely changed the condition of things, and the affected trees speedily recovered. To show the vast increase of this species of Lady Bird, I may state that in June of the present year (1896) many of the large trees in the city of Honolulu had several square feet of their bark entirely hidden by the larvæ, which formed great white masses presenting an extraordinary appearance.* Its useful work in coping with the Mealy Bugs (*Dactylopius vastator*, Maskel, and *D. Ceriferus*, Newstead)—the former said to be the most pernicious coccid ever met with, have been recorded by Mr. Koebele himself.†

* Secretary of the Committee appointed by the Royal Society and British Association for investigating the Fauna of the Sandwich Islands.—*Agricultural Journal, Cape of Good Hope*, Vol. X., No. 10, p. 581.

† Report of Entomologist of the Hawaiian Government.—*Planter's Monthly*, Honolulu, Feb. 1897. Fig. 67.

Tick Fever.

NOTES ON THE INOCULATION OF BULLS AS A PREVENTIVE AGAINST TICK FEVER AT RATHDOWNY AND ROSEDALE.

By C. J. POUND,
Director of the Queensland Stock Institute.

In consequence of the almost complete destruction of serviceable bulls by ticks on a number of the Northern cattle stations, there has naturally sprung up a demand for this class of cattle from the well-known breeding runs in Southern Queensland and the northern districts of New South Wales.

Up till quite recently the losses amongst these unprotected bulls travelling from clean into permanently tick-infested districts has been exceptionally high—in some cases from 50 to 70 per cent.; while in one case which recently came under my notice, every animal in a mob of 57 Hereford bulls died. This has become such a serious matter for the Northern stockowners that it was decided to see if bulls could not be taken from clean into tick-infested country after having been inoculated with blood from an immune animal.

In the early part of August last, Mr. William Collins, of Mundoolun, informed me that he was anxious to obtain a number of bulls from New South Wales, and have them inoculated prior to sending them to Inkerman, a grossly infested property on the Lower Burdekin. I pointed out to Mr. Collins that it would be advisable to obtain only young animals up to two years; as old bulls are more susceptible, consequently there must necessarily be a heavy mortality.

In all my lectures I always bring prominently under the notice of stock-owners the following:—

When ticks first appear in a herd the first animals to succumb to tick fever are bulls, especially the old ones; next in order come breeding cattle (cows); then bullocks and spayed cows; but the least susceptible of all are the young animals, and, practically speaking, there is little or no mortality from tick fever amongst yearlings or calves at foot.

At a later date Mr. Collins informed me that he had purchased 35 Shorthorn bulls, all under two years old, a few of them being very poor, while the majority were in a fair condition.

On 20th August, I proceeded to Rathdowny, on the Logan River, and inoculated each animal with 5 cubic centimetres of blood taken from No. 18 steer. The animal, No. 18 steer, from which the blood was obtained for inoculating the bulls with, was inoculated at Mundoolun five months previously with 5 cubic centimetres of defibrinated blood from Inkerman steer B, and as a result suffered a very severe attack of fever, the temperature rising on the nineteenth day as high as 108 degrees 3 minutes, and for three days the urine was distinctly claret-coloured. I may here state that, owing to the blood being taken from an animal which had previously suffered from an extremely severe attack of fever, Messrs. W., G., and R. Collins fully anticipated that several of the bulls would have died; but, as a matter of fact, Mr. R. Collins informed me on Sunday last (17th October) that not only had no deaths occurred, but every animal had completely recovered from the effects of inoculation, and they were in good health and fat condition. After inoculation the 35 bulls with 4 steers, also inoculated, were placed into a good prairie grass paddock with free access to plenty of good water.

On 28th August, Mr. Nugent Wade Brown suggested to the Minister for Agriculture that I might be allowed to inoculate a large number of his bulls at Rosedale, which subsequently were to be sent to a tick-infested district in North Queensland.

Having received the necessary instructions, I proceeded to Rosedale on 8th September.

The blood used for inoculating these animals was taken direct from a calf which had been inoculated on 3rd March last with 5 cubic centimetres of blood from the Inkerman steer, resulting in a very mild attack of fever.

Altogether 88 bulls, 3 steers, and 2 poddy calves were inoculated, each with 5 cubic centimetres of défibrinated blood.

The bulls (Devons and Shorthorns) were from two to five years old, and a few probably older, but the majority were about four years old, most of them being in a very poor condition, while few were in fairly good condition.

I understood from Mr. Brown that wherever the bulls were inoculated they would be removed to an adjacent paddock for a period of six weeks or longer, until completely recovered from the effects of inoculation, instead of which Mr. Brown afterwards informed me that they must go back as soon as possible to Moralgaren, which meant three days' hard travelling. I told Mr. Taylor, who was in charge, that this being the case it was absolutely necessary for the bulls to be placed in a good paddock with plenty of grass and water, when he at once informed me that there was very little grass in the paddock where the bulls were going, but as soon as he was able to muster cattle from a good grass paddock the bulls would be removed to it. However, the bulls were travelled for three days to Moralgaren, but I have not heard whether or when they were removed to the fresh paddock.

On 14th October, Mr. Hooper, Stock Inspector at Gladstone, visited Moralgaren; and Mr. Taylor furnished him for me with the following information respecting the inoculation experiment:—

8th September	...	88 bulls and 3 steers inoculated.
22nd "	...	A number apparently sick.
23rd "	...	8 bulls died.
24th "	...	19 "
Up till 8th October	...	8 "
	...	1 steer died.
		36, total number dead.

The latest report is that the remaining 53 bulls and 2 young steers have completely recovered, and are daily improving in their condition.

Of the 36 animals which died, 33 were old bulls, 2 young bulls, and 1 old coarse steer.

I am of opinion that the heavy mortality was largely due to the bulls being inoculated at an age when they are extremely susceptible to any form of fever, whether produced naturally or artificially; at the same time it is highly probable that the travelling and subsequent moving (?) of the bulls tended to increase the death rate.

Mr. Nugent Wade Brown is to be highly complimented for the trouble and expense he has incurred in taking over all the responsibility of this most valuable experiment, and I sympathise with him in the loss he has sustained; at the same time, if the surviving 53 inoculated bulls reach their destination in the permanently tick-infested districts and remain immune to gross tick-infection, the result of the experiment will be regarded by every stockowner throughout the colonies as highly satisfactory, when compared with the removal of uninoculated bulls, where the losses amount to from 60 to 70 per cent., sometimes 100.

Some considerable time may elapse before the method of preventive inoculation for tick fever is sufficiently perfect, so as to ensure the successful inoculation of old bulls without incurring any losses; therefore, considering

that young animals are practically insusceptible to a severe attack of fever after inoculation, it is advisable to inoculate only young bulls intended for tick districts, and reserve the older uninoculated animals for the Southern clean districts; moreover, I would also strongly recommend to all stockowners, in clean districts, to avail themselves of the present opportunity of systematically inoculating all their young stock at the time of branding, so that they may be rendered immune before ticks make their appearance.

NOTES ON TICKS AND TICK FEVER.

There are several important points to be remembered in connection with a primary and subsequent invasions of ticks among cattle in clean districts, viz:—

(1) A primary gross tick-infection is more frequently accompanied by a heavy mortality, but the surviving animals are invariably immune to subsequent attacks;

(2) A primary slight invasion of ticks is rarely accompanied by losses, and only renders an exceedingly small percentage of animals immune to a subsequent gross infection;

(3) Continued slight tick-infection always more or less tends to produce permanent immunity from subsequent gross tick-infection;

(4) The virulence of an attack is largely influenced by the ages and sexes of the cattle attacked, the old animals, especially bulls, being more susceptible than young animals.

These results are based upon several years' practical experience and careful observation, not only in this colony, but also in the Southern States of North America and South Africa.

The following carefully ascertained facts are several out of many examples which illustrate the correctness of the above remarks:—

1. Dr. Hunt's experiments at Hughenden, and others carried out in America and South Africa, prove that a severe and sometimes a fatal attack of fever may be produced by placing a large number of ticks upon a susceptible animal. The mortality on some of the Gulf stations, on the Flinders and Norman Rivers, and amongst the dairy and other cattle in and around Townsville, was occasioned, practically speaking, by a sudden gross invasion of ticks.

2. The historical Airdmillan outbreak of ticks was as follows:—About 2,500 head of cattle, travelling from Highbury and Devoncourt Stations, brought ticks with them to the Airdmillan paddocks on the Lower Burdekin in the winter of 1895. All the animals were more or less slightly tick-infested, and remained so—apparently in good health—for several weeks. Quite suddenly in October, a few weeks later, conditions being favourable, the ticks increased at an alarming rate, and the cattle became grossly tick-infested, and in six weeks 1,400 died of tick fever, the remaining 1,100 being sent to the boiling-down works.

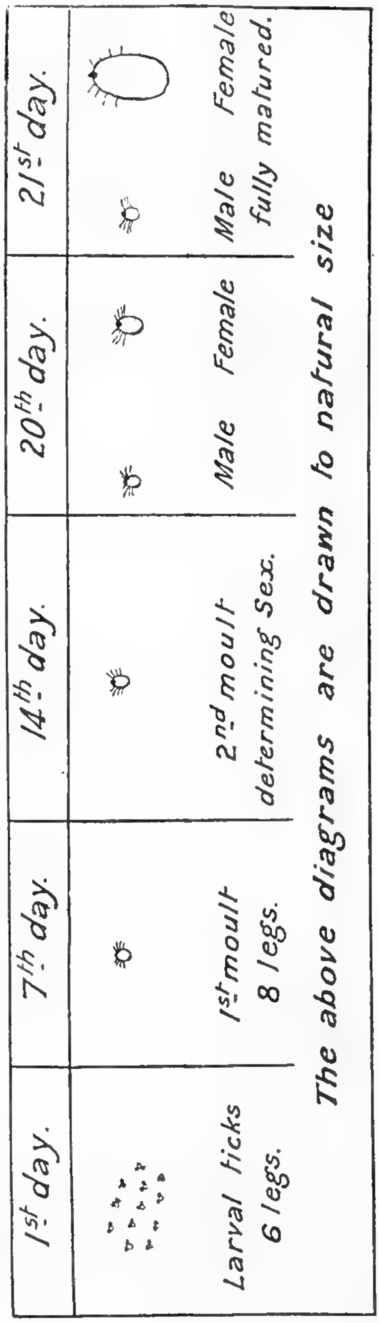
3. As an illustration of (3), I may mention the cases of Gracemere and Mount Cornish. On both these places (the former for, perhaps, over twelve months, and the latter for over two years) the cattle have been slightly tick-infested, but remained perfectly healthy. At the present time, on both properties, the cattle in certain paddocks are daily becoming grossly tick-infested, but still there are no signs whatever of sickness, all the animals looking healthy and fat.

4. All experiments conducted by placing ticks on cattle or by the direct inoculation of virulent blood prove that young animals are only slightly susceptible, fatal cases being extremely rare. On nearly all permanently tick-infested stations at the present time there are, comparatively speaking, no serviceable old bulls which have survived the primary gross infection. The removal of bulls from clean into tick-infested districts invariably results in a very heavy mortality amongst the older animals, while the young ones, especially weaners, survive.

The fluctuations in the number of ticks during a primary and subsequent invasions are entirely dependent upon one or several of the following conditions:—

	A.		B.
I.	Cattle restricted to small areas.	I.	Cattle running on open country.
II.	Overstocking.	II.	Understocking.
III.	Moist climate.	III.	Dry climate.
IV.	Summer months.	IV.	Winter months.
V.	Dense vegetation, as blady grass.	V.	Scanty vegetation, as Mitchell grass.
VI.	Absence of natural enemies of ticks.	VI.	Presence of natural enemies of ticks, as ants, insectivorous birds, &c.

The following diagrams illustrate the life-history and development of the cattle tick:—



Larval ticks are capable of living, in some instances, for a period of over four months without food or moisture, apart from their host.

These young ticks attach themselves to their host singly, and not in pairs or clusters.

Up till six days their growth is scarcely noticeable, but on the seventh day they undergo a change and throw off their skin, and are then seen with an extra pair of legs.

From the seventh to the fourteenth day they grow but very little, and on the latter date they undergo a second change, which determines the sex. If the change should result in a female, she still remains attached in the same place; but if it should result in a male, he immediately releases his hold and wanders about amongst the hair of the animal until he finds a female with which he mates, attaching himself to the animal just beneath the female.

The pair will remain attached to their host until the twentieth day, increasing in size but very slightly, the female being a little larger than the male. From the sixteenth to the twentieth day the male fecundates the female.

On the twenty-first day the female becomes fully mature, releases her hold, and falls to the ground; then crawls to some secluded spot and lays her eggs, which in course of time (from three to nine weeks) will hatch, and then the life-cycle commences again.

After the departure of the female, the male tick sometimes remains for several hours, when he becomes detached, falls to the ground, and rarely lives longer than two or three days.

The following on the subject of inoculation for rinderpest at the Cape of Good Hope will prove interesting:—

Dr. Alexander Edington, Bacteriologist to the Government of Cape Colony, claims to have invented an effective preventive to rinderpest. He found that the blood of animals affected with the disease, when treated with citric acid and kept long enough to ensure the death of the contagium, conferred immunity upon animals injected with it. Bile, treated in the same way, with half its quantity of glycerine mixed with it, acted equally well. Animals injected with 20 cubic centimetres of either preparation proved immune from infection in a great majority of cases, when virulent blood from animals suffering from rinderpest was afterwards injected. Dr. Edington, after experimenting on a small scale, with perfect success, practised his preventive method upon a large number of large herds, and the highest mortality in any herd has been a little over 3 per cent.

Dr. Edington claims for his mixture three great advantages—

(*a*) That the disease cannot be spread by the use of glycerinated gall.

(*b*) That a great economy is effected by the use of glycerine: all galls being available.

(*c*) That the mixture will keep.

The *Agricultural Journal* of the Cape of Good Hope, commenting on these claims, disagrees with the first claim as being unsatisfactory and certainly not novel, as glycerine was abandoned by Dr. Koch as useless.

With respect to (*b*), an increase of the dose of bile and glycerine from 10 c.c. of gall and 5 c.c. of glycerine to 24 c.c. of the mixture, containing 16 c.c. of bile, does away with the plea of economy. The third advantage (*c*) is undoubtedly true, as the mixture will retain its extremely feeble minimising power for a considerable time.

Forestry.

FOREST CONSERVANCY.

No. 1.

BY A. J. BOYD.

THE apathy with which the bulk of our fellow-colonists, who are not immediately interested in the timber trade, view the question of a future supply of one of the most important of our natural products, is as surprising as it is culpable. The reason for this carelessness lies in the fact—first, that the generality of people are ignorant of the value of our forests from a climatological point of view; secondly, from a hazy idea that our supplies of timber suitable for building purposes, for railway sleepers, for wood-paving, for piles, &c, &c., are inexhaustible. Having had much practical experience of timber-getting many years ago, I am in a position to prove, not only that these supplies are not inexhaustible, but that many districts have become absolutely denuded of all timber suitable for the above purposes, and that in some instances even timber for firewood is no longer obtainable.

Whilst most countries under European rule are expending vast sums of money in not only preserving existing forests, but also in reafforesting large areas already denuded of timber; whilst in the United States some millions of acres are reserved as State forests, we in Queensland seem bent upon getting rid of these valuable assets as quickly as we possibly can, never stopping to think of the future or of the trouble which must inevitably follow such a mistaken policy, and all the while Nature herself is trying to teach us the lesson that forests are an absolute necessity for our well-being. A constant warfare is going on between man and Nature in trying, the one to subjugate the forest, the other to assert the imperious necessity for their continuance. If man were to desist from the struggle, the forest would predominate almost all over the world. We can well imagine the forests of the prehistoric world, before man became a denizen of its densely timbered solitudes.

Palæobotanists have given us a very fair idea of the trees of our earth in primeval times. The whole face of the dry or swampy land was occupied by enormous trees, which have only diminutive representatives at the present day. Lycopods, which now only grow to the height of at most 3 feet, then attained an altitude of from 80 to 100 feet. For countless ages these dense forests grew and flourished, and then were overwhelmed by some convulsion of Nature, to be buried beneath hundreds of feet of rock until once more brought to the surface in the shape of coal, whilst fresh forests grew above them to be submerged in their turn. Still, Nature kept on the struggle, and proved victorious. We may see the same struggle going on to-day under our own eyes. If we fell a dense scrub and burn off every stick of timber and take out every stump, and then leave it to itself, what do we observe? That in a couple of years a new scrub clothes the denuded patch with a dense growth of generally dissimilar timber, which obliterates all traces of man's handiwork. But in a densely peopled country, man is generally the conqueror, and that to his own detriment. He has employed his art to turn vast stores of timber—the growth of ages—to manufacturing uses. Had he stopped here, all would have been well. Forests are made for man's use; they are intended to be cut down as required. But in his insatiable greed and want of foresight, he has destroyed the timber on large areas of once fertile country,

and as a natural consequence the land has become in many cases unfit for agricultural or pastoral occupation. The covering of timber preserved the soil from being baked by the sun as well as from being frozen by the icy blasts of winter. The falling leaves and rotting trunks formed a rich humus for the growth of succulent grasses and herbs, whilst the roots of the trees, assisted by those of the herbage, held the soil together, and the heaviest rains and floods were powerless to carry away the fertile parts of it, and thus there was always a continual supply of grass on the forest lands for the fattening of stock, and whatever was required for cultivation purposes was nourished as stated by the fallen leaves of many centuries, and the crops were sheltered from windstorms by the surrounding forest.

Now see what man has accomplished by his ruthless destruction of the forests. He has laid bare the slopes of the hills where previously the fertility was regulated by the gentle flow of the rain water as it found its way towards the level country. There is nothing now to impede the rush of water descending in torrents from the mountains. The surface soil is disintegrated and carried down on to the low fertile lands, often covering them up with a mass of sand, shale, and other rocks, and thus rendering them, in their turn, useless for cultivation; and the result of this destruction of forests has been that where formerly we saw smiling fields and luxurious crops there now only remains a barren wilderness of rock and sand, with a scanty covering of almost useless grass and herbs. The cleared scrubs on the hillsides gradually lose their upper stratum of humus, and the crops becoming scantier year by year, indicate the mischief which has been done.

Now men are beginning to awaken to the necessity of reproducing these lost forests artificially and of conserving those still remaining by legislative enaction. In Queensland we are still in the destructive stage, although much is being done by the Government to protect and replace the valuable timber trees of our scrubs. Here and there attempts have been made by private individuals to preserve and replant some of the indigenous scrub timbers. In 1879 I planted about 1,500 young red cedar-trees in the mountain scrub at Forest Hill, near Laidley. They were planted in the scrub without any clearing, and some few were planted in the open on the cleared ground. In the course of a year or two those in the scrub had all died, whilst those in the open throve well.

But for one tree planted there are 10,000 destroyed by axe and fire, and this senseless destruction will continue to go on until more attention is paid to the warnings and instructions issued unceasingly by the Department of Agriculture. The reports on Forest Conservancy by Messrs. P. McLean (Under Secretary for Agriculture), P. MacMahon (Curator of the Brisbane Botanic Gardens), A. McDowall (Surveyor-General), and other experts in 1890 are deserving of all consideration, dealing, as they do, with the whole subject. Mr. McDowall says:—"It can hardly be questioned that the time is approaching when the wholesale destructions of timber in many parts of the colony—much of it of a wantonly wasteful nature—will be severely felt. Suddenly, when the depredations of a careless population have produced the inevitable result, the subject of forest conservancy will assume a prominence not yet accorded to it, and it will be a matter of general wonder that our short-sightedness did not allow us to realise that destruction without replenishment must lead to scarcity." Forests were made for the use of man, and, if properly managed, a perpetual supply of timber for all purposes can be maintained. This has been practically demonstrated by a firm of saw-mill proprietors who held large timber selections in the Noosa district at Lake Cootharaba. These far-seeing men kept up a regular supply of kauri and hoop pine by judicious systematic thinning. The scrubs on their properties contained great quantities of these valuable soft woods, and to ensure constant supplies the land was divided into large blocks, of which one was culled of all pine timber of a certain diameter. When this first block was worked out, the next was taken, then the others in rotation, until at the end of five or six years a large quantity of the

pine in the first block left untouched before had reached the stated diameter and was ready to be again thinned. Meanwhile all the young saplings were coming on for use in after years, and thus the supply was perpetual.

It is probable, although the best authorities are not agreed upon the subject, that to the wholesale destruction of our forests and scrubs may be attributed the lessened rainfall and consequent drought in many pastoral and farming districts. It is generally supposed that timbered districts attract more rain than bare plains.

Writing of "Forests in Relation to Climate and Rainfall," Mr. W. Schlich, Principal Professor of Forestry at the Royal Indian Engineering College, Cooper's Hill, and late Inspector of Forestry to the Government of India, says:—

"The relation between forests and the climate and rainfall of India is of a very peculiar nature. On the one hand, a covering of forest vegetation reduces the temperature of the air and soil, increases the relative humidity, and tends to increase the rainfall; while, on the other hand, the exceptionally high temperature which prevails in spring and early summer over the centre of the Indian peninsula brings about the summer monsoon rains, on which the welfare of India depends. In other words, extensive afforestation might increase the quantity of locally formed clouds and produce local rainfalls, but it might also weaken the force of the south-west monsoon wind and consequently the accompanying rainfall.

"It is, perhaps, difficult to say what the ultimate effect of a general afforestation might be, but it may reasonably be assumed that the effects of forests, however extensive, are not likely to produce a quantity of rain which would make up for any weakening of the south-west monsoon. As a matter of fact, however, more than half the area of Madras, Bombay, the North-western Provinces, and Bengal is under cultivation, and a considerable additional area has been appropriated as grazing grounds, so that not more than one-fourth could remain under forest—an area which may be sufficient to moderate the temperature locally, but which is not likely to interfere with the advent of the annual south-west monsoon. The latter must for ever be the main source of moisture in India.

"Apart, however, from these theoretical speculations, *it has yet to be proved whether afforestation in low or level lands affects the rainfall at all.* [The italics are my own.—A.J.B.] The extensive observations made of late years in Europe have not yet led to any final conclusions, and those carried out in India have not extended over a sufficient number of years to permit of any conclusion at all. Several stations which show a specially large increase (in rainfall) are either situated far from the reserves, or in their vicinity little forest conservancy has been effected."

Again, with respect to floods, the roots of the trees on the hillsides bind the soil together, and as a natural consequence the rains sink gently into the ground, being intercepted by the roots and the undergrowth. When these are gone, the superabundant water rushes without hindrance down the hillsides, carrying off in its course the best of the soil and leaving in its wake great gullies which previously were only tracks. The mass of water has no time to permeate the soil, but makes its way straight to the creeks and rivers, which, swollen to an abnormal height, overtop their banks and submerge the surrounding low country, carrying ruin and desolation to many a before smiling home, and involving the State as well as private citizens in enormous amounts to make good the loss.

Now, the first subject of inquiry which suggests itself is: What are the causes which operate wastefully and injuriously upon our timber supplies?

In answer to this question, it will be found that the waste in a primeval Australian forest is apparently very great. In forests and scrubs still untouched by the hand of man, vast quantities of large timber, including several varieties of hardwood, pine, cedar, and beech, may be seen strewn over

the ground. To the ordinary eye this would appear a heavy loss, and so it undoubtedly would have proved, had there been a population a hundred years ago to utilise it. But these trees have either long ago arrived at maturity and commenced to decay (a necessary process of nature in the interests of the young timber), or else they have been attacked by termites and grubs, which perforate the wood, and thus render it useless for any other purpose than that of fuel. Much destruction may also be set down not only to the ravages of white ants but also to the effects of violent windstorms and lightning.

These causes, then, can hardly be taken into consideration as wasteful. For this result, we must turn to bush fires and the hand of man.

With regard to the first—*i.e.*, bush fires—the operation of fire is scarcely so apparent in the comparatively densely peopled Southern coast districts as it is further to the northward and westward, where population is sparse and overstocking avoided. In some portions of the latter part of Queensland, the grass, during the rainy season, grows to an incredible height, often so high as almost to conceal a horse. In addition to this, climbing plants and annual shrubs grow thickly amongst the dense herbage. When the rains are over, and the dry winter season has fully set in, bush fires of enormous extent occur, either owing to the carelessness of travellers or to the wilful act of the aborigines, who fire the grass for the greater convenience of hunting or travelling. These fires are very destructive to the young timber, thousands of young saplings falling victims to the flames or to the fall of the worn-out burning giants which sheltered their young growth. These bush fires are frequently followed by a dense growth of young black-wattle scrub, and the superabundant shade thus supplied has the effect of checking the germination of seeds which may fall from the larger trees. The loss by bush fires does not apply to the dense scrubs, which, owing to the moisture retained by the thick undergrowth, are practically fireproof.

We now come to the waste caused by the progress of settlement. This we find to be the most serious, and most requiring instant and earnest attention.

In the early days of settlement in Queensland, when agriculture received little or no attention, the dense scrubs in the South, on the banks of the Brisbane and its tributary creeks, the Logan, Albert, Pimpama, Coomera, Nerang, Pine, Caboolture, Maroochie, and in the North, the Burnett, Mary, the Barron, Johnson, Bloomfield, and others, besides other eastern rivers, were rich in supplies of magnificent hoop pine, cedar, beech, silky oak, yellow-wood, &c., whilst on their edges and in the forest were quantities of stately Eucalypts of many kinds.

In time, splitters and timber-getters got to work and "picked the eyes" out of the country. Then commenced the losses and waste. It is well known to the initiated that many trees, fair to the eye at a certain height from the ground, prove to have a "wind" higher up. This wind, or twist, renders that portion of the tree valueless to the splitter, whose business would not admit of his utilising it by cutting roads through the scrub to draw sound, but to him useless, logs to the river for transmission to the saw-mill. He, therefore, abandoned most, if not the whole of the tree, which in the course of nature decayed and was lost for ever, so far as timber was concerned. Often a tree would hang suspended by the vines overhead. (I am, of course, alluding to timber-getting in scrubs.) The splitter found it simpler to fell another tree out of the abundance around him than to lose time by cutting away the surrounding scrub, by which means alone he could secure the fall of the first. Again, trees were often lost by felling them on gusty days. The result was often what is technically known as a "kick-up." That is to say, before the saw had fairly cut into the "shoulders," the wind seized the head of the tree, and, there being too much wood uncut by the saw, the tree split from the stump to a height of from 5 feet to 15 feet, then broke short off, when it either remained supported by the split stump or fell to the ground useless as a mill log. Floods again were a great cause of loss. Hundreds, if not thousands, of logs of both pine and cedar have been swept out

to sea, the owners being powerless to preserve them. At this moment numbers of fine pine logs may be seen above high-water mark, lying piled up on the beach between Southport and the Tweed Heads, carried there during floods. The writer, in 1863, cut 200.000 feet of hardwood on the Brisbane River, opposite Moggill Creek, and during a flood season some 500 or 600 fine logs, lying drawn to the creek bank ready for removal by punt, were swept into the river and are possibly lying there to this day. An account still in his possession of the value of seventy-five of these logs shows that they contained 71,530 feet of timber, valued at the mill at 4s. per 100 feet. The largest of the trees felled contained 3,591 feet, the average being over 900 feet per tree. They represented a fortnight's hard work.

Droughts have operated equally disastrously. Men have worked for two or three years with expensive appliances in cedar scrubs. Vast quantities of splendid logs have been hauled to dry creeks communicating with navigable rivers, in the expectation that the periodical floods would carry them to the spot where a raft could be constructed. The floods have not been heavy enough to perform this work, and hence the logs were left to rot on the creek banks.* But even all this destruction has been as nothing compared with that caused by agricultural settlement and by indiscriminate licensing in the "good old days." I will do most farmers the justice to say that they preserved as much as possible the heavy pine they found in the scrub land they had purchased. but the exigencies of their avocations demanded the clearing, burning off, and stumping of their land. Hence myriads of young pine-trees, beech, silky oak, and yellow-wood were unavoidably destroyed. I have myself for farming purposes been compelled to cut down scores of trees, which, had they been growing until now, would have formed grand food for the saw-mill.

The losses accruing to the colony, however, by agricultural settlement are partially recouped by the substitution of one commercial product for another, and although it may fairly be argued that an acre of maize is not an equivalent for an acre of pine or cedar in a marketable condition, still, as it would require from twenty to thirty years—according to soil and situation—to produce an acre of pine-trees 2 feet in diameter, it would not be for the benefit of the country that all farm produce should be imported, as this would mean sparse population and slow progress. A few timber-getters would very soon fell the couple of hundred pine-trees on an acre of land; and unless the laws on the subject were very stringent with regard to replanting, a sum of about £200 would represent the whole gain in the time mentioned to a few men, whereas the same area would support a family of agriculturists year after year if it were devoted to agricultural pursuits. Thus, although the demands of agriculture undoubtedly contribute largely to the denudation of our forests and scrubs (as does the ringbarking so extensively practised by the pastoral occupants of the country), the real question at issue becomes finally narrowed down to lumbering and lumber-mills.

In connection with ringbarking, it should be remarked that the operation has a decidedly good effect upon the pasture by increasing the covering of grass and other herbage, and also by increasing the supply of water on a run. Springs have been known to break out after the trees have been "ringed," where no spring was formerly suspected. If we consider that a well-grown gum or ironbark will absorb as much as a hogshead of water from the soil, if not more, in twenty-four hours, it may be conceived that the ringing of 100 such trees on an acre must have a beneficial effect upon the subterranean water supply, whatever baneful influence it may exert on the pluvial supply. In my next paper I shall briefly consider the two above-mentioned factors of destruction, and afterwards discuss the most obvious remedies.

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* A peculiarity in the rotting of a beech log was pointed out to me by Mr. W. Pettigrew, proprietor of the Brisbane saw-mills. A large beech log had been sawn in two in the scrub at Mooloolah, and abandoned. The sawn ends were close together, and the timber had rotted inwards to a depth of six or seven inches, whilst the end exposed to sun and wind was quite sound.

General Notes.

SCENT FARMS.

AN INDUSTRY TO BE.

In our last issue we drew attention to the possibilities of scent-farming, pointing out how, by the help of the children on a farm, the scent of lavender and tuberoses could be gathered in its crude form and made a source of revenue. Mr. George Stacey, writing under the above heading to the *Journal of the Bureau of Agriculture* of Western Australia, says:—

"Every new means for the production of wealth in a young country is a step towards its assured and lasting prosperity. . . . .

"In this vast territory there should, in the future, spring up numerous little industries, one of which will undoubtedly be the making of scents from many of the innumerable perfumed flowers that deck the face of the land at this season. Take our almost 'national' flower, the 'sweet boronia.' Can any perfume more delicate be conceived? Or one more lasting? In the days to come . . . . scent farms will be established, and the fragrance of the fairy bells caught and preserved."

Mr. Stacey then describes the method of doing so:—"Distillation being only suitable to strong scents like neroli, it is advisable to follow the French system adopted with such delicate flowers as the violet. The requirements are simple, and consist only of a frame formed of four pieces of wood 18 inches long and 1 inch square on the ends, rabbeted to half-an-inch, so that an end section is like the letter L. These four pieces must be mortised into a wooden base at such a distance that the angle of each is one foot distant from that of its neighbour. Particular care must be taken that these corner-posts are absolutely vertical, for the next thing is to slide into each pair a piece of glass 18 inches long, and, in the case of one pair, 12 inches wide, and in that of the other 11⅞ inches. These being placed in position form the sides of a deep glass box, the bottom being formed by a piece of glass 12 inches square laid on the wooden base and between the angles of the four corner-posts; a couple of dozen pieces of glass 11¾ by 11⅞ inches complete the mechanical equipment."

Now it is necessary to prepare about a dozen pounds of pure lard. This is done by boiling in pure water and using absolutely clean vessels. The operation is repeated three or four times with different water each time, and the purified grease should then be packed away in an earthenware vessel. The scentmaker's equipment now lacks nothing but the flowers to be treated; and the boys and girls of the family need be early risers, for "sweet boronia" pours out her fragrance with the rest of "Nature's fairies with scented breath" in homage to the sun's glorious majesty. Daybreak must therefore see the younglings afield, where, with light and nimble fingers, they may gather the blossom-laden spray. Nor use violence, boys and girls, for the home of the sweet fay, who by night from Nature's store distils such fragrance, is worthy of reverent and gentle touch.

When the load of blossoms has arrived it is necessary to separate them from their stems. This is best done by means of a "heckle," or comb, made by driving fine nails through a piece of wood at a distance of about an eighth of an inch from one another, thus forming a sort of comb, which is set at the end of a table. The sprays, shaken free of dew, are drawn through. The blossoms thus detached from their stems have a certain amount of foliage amongst them which must be separated by means of a sieve of such measurement as will allow the passage of the leaves, but not of the flowers. Now one side of the glass box is withdrawn, and one by one the squares of glass receive

an even coat of lard about ¼ of an inch thick. This is completely covered with the blossoms, and the plate slid to the bottom of the box. When all the plates are treated and placed one upon another till none remain, the fourth side of the box is reinserted and the top covered, the whole being put away in a cool place till evening, when the flowers, having yielded their perfume to the grease, must be removed. The operation is repeated daily till such time as the grease is saturated with perfume, when it may receive one of two treatments. The lard may be removed and packed in wide-mouthed glass jars, in which state it is of a saleable value in London or Paris of from 25s. to 30s. per lb. Or the lard may be treated with rectified spirits of wine; and the perfume being absorbed, the lard becomes again ready for treatment as before, and the spirit is saleable when saturated with perfume at about 3s. 6d. per fluid ounce, or £3 10s. per pint.

There is, doubtless, much trouble in treating flowers thus, but then, if there were not, the high price obtainable would not exist. However, there is the description of the process as carried out on the flower farms in the south of Europe, and it remains for some enterprising citizen to say whether the profits will pay him for the labour of his boys and girls, for, after all, the labour is only that of children.

RAIN-DISPERSING

WE have heard very often of rain being produced by the explosion of gunpowder and dynamite, and there are many persons in Brisbane who will remember the experiments in rain-making by Professor Pepper, by means of gun discharges and by the elevation of an enormous kite. Now comes a report from Mr. Germain, United States Consul at Zürich (Switzerland), on the prevention of hailstorms by the same means that have been used to encourage a downfall of rain.

It appears that Mr. Albert Stiger, burgomaster of Windisch Freistritz (Lower Steiermark, Austria), owns extensive vineyards situated on the southern slopes of the Bacher Mountains, a locality often visited by destructive hailstorms. To protect his vines from hail, he decided to try the shooting or explosion system to scatter the clouds and drive away approaching hail or heavy rainstorms. Six stations were therefore erected on the six most prominent summits surrounding the locality, and commanding the territory about two miles in extent. These stations sheltered ten heavy mortars each. On the slightest indication of a storm, the guns were immediately manned and loaded with 120 grammes (nearly 4 oz.) of powder, and shooting commenced simultaneously and continued regularly out of the sixty mortars until the clouds were scattered and the storm had blown over. These experiments were anxiously watched by the citizens of Windisch Freistritz last summer.

Threatening black clouds made their appearance over the summits of the Bacher Mountains, and at a given signal all the mortars were fired off. The continuous detonations in a few moments caused a sudden reaction in the movements of the clouds. It is said that the cloud opened up funnel-like, the mouth of the funnel began to rise in the form of consecutive rings, expanding gradually until all the clouds scattered and disappeared. There was no hail nor even a sudden downpour of rain. The same experience was gone through six times during the summer, and proved a successful preventive in each case. We await the views of Austrian meteorologists on these experiments. Rain-makers who have put their trust in explosions must hide their diminished heads before the rain-dispersers.

EXPORTING CREAM.

IN New Zealand it is said that frozen cream has been exported from that colony to England. It arrived in good condition, and the resulting butter was sold at 1s. 1d. per lb. That cream in a frozen state can be successfully exported has been proved long ago by exports from Denmark. Whether the longer distance will militate against a successful export trade from New Zealand and Australia is another matter.

WEIGHT OF A STACK.

A ton of dry hay contains 400 cubic feet. To ascertain the weight of hay in a settled stack, multiply the length, breadth, and height of the stack together, and divide the result by 400.

SETTING EGGS.

Mr. Thomas Jones, of the Government Savings Bank, gives it as his opinion, as an expert in poultry-breeding, that one should never give up a setting of eggs as a failure, and gives the following remarkable experience:—He set a hen on thirteen prize eggs on the ground. On the third morning he found that the hen had broken one of the eggs, and had so covered the other twelve with dirt that they could not be seen, and, furthermore, she refused to sit again. He then placed the eggs under an old Brahma hen. She sat for a week, and then behaved like the first hen, covering the eggs with dirt, dying a day after the performance. Mr. Jones now divided the eggs, placing half under a hen belonging to a neighbour, and half under a little black Hamburg which only sat six days on them. The eggs were then placed under another strange hen. They had been twice washed with lukewarm water, had been under five different hens, had been moved to four different nests, and yet the whole twelve chicks came out, and are now doing well. They are Minorcas and Brown Leghorns.

LECTURE ON POULTRY-KEEPING.

Mr. A. F. Hunter, of Boston, Massachusetts, addressing a meeting on poultry-keeping at the University Extension College, Reading, said that when he started in business, some fifteen years ago, he decided to engage himself in poultry-farming alone. At the present time he had about 500 hens, forming the laying stock, and some 2,000 chickens. He found during his travels that the methods introduced in his farm were somewhat new and unknown to many gentlemen whom he had consulted while in this country. It was possible by the method he had adopted to put 400 fowls on an acre of ground—an accomplishment which had been a great surprise to Britishers. Moreover, what proved a still greater astonishment to such gentlemen as Mr. Lewis Wright, was the fact that they were able to keep the grass growing in the runs which were prepared for the fowls. The houses used in poultry-farming were very large. In his own case the pens were 12 feet square, and able to comfortably accommodate fifteen birds. In the front of each house he had erected a yard, commonly called a park, which was 18 feet wide and 125 feet long. Finding that the houses were too much closed up in certain times of the year, two years ago he had a door cut in each one of these pens about 4 feet square, and this he opened in the middle of the day for a few hours to thoroughly refresh the place. This had proved a great improvement. The scratching shed was built in sections, 18 feet by 10 feet, with doors arranged in front of each of the partitions. For convenience he had the front of the scratching shed covered with wire netting. Connected with the shed was a yard, 18 feet by 125 feet, and in the yard, with pen and shed attached, he put twenty-five birds with even better results in regard to production than in the other case already referred to. Last year a neighbour of his succeeded in raising 186 eggs per bird from about 300 pens, and they expected ere long to get 200 eggs per bird every year. During the past few weeks he had been going amongst English poultry farmers, and he found a rapidly growing interest being taken in this industry. What he came over for specially was to get some idea of the mode of fattening now in vogue in this country, and also the procedure followed in trussing. He hoped they would take it up in America on lines similar to those in England. They considered they were doing well, but they hoped to do better.—*Mark Lane Express.*

POULTRY-FARMING.

A farmer in the current number of the *Land Magazine* gives the results of poultry-keeping on a somewhat considerable scale. He has found that hens shut up in ample pens give the minimum of trouble, and lay the maximum of

eggs. His plan is to erect "houses" according to his requirements, and to enclose with ordinary wire netting, fixed to upright poles in the ground, spaces around each, ranging from 98 to 277 square yards. The ground set apart for the runs was the rough patches generally found near to the homestead and outbuildings. At the outset he selected fowls that were good layers, such as a cross between light and brown Leghorn cocks and the dark Brahma hens. They were of course most prolific in March, April, May, June, and July, but March and April pullets began laying on 1st October, so that he had a good supply of eggs all the year round. The food in the morning consisted of good soft meal, with a sprinkling of meat crissel in summer, and in the very cold weather Indian meal, which is a heat-producer. In the evening, wheat, buckwheat, dari, or heavy oats were given, separately, not mixed. No maize was thrown down, as it is fat-producing and lessens the laying capacity of the hens. There was no limit to the supply of water and green stuffs. The results were highly satisfactory. The egg year ends on 30th September, and from 1st October, 1895, to 30th September, 1896, our poultry farmer had an average of 150 fowls, and collected during the year 18,963 eggs, in addition to rearing 154 broods of chickens and ducklings. October and November were the only two months when the eggs were below 1,000 a month. The best results were from two pens, jointly covering 503 square yards, and containing fifty birds in the two, which yielded 7,727, or an average, roughly, of 154 eggs each in the year. For the present year 177 of these fowls have given the grand total of 22,270 eggs. The record is as follows:—October (1896), 968; November, 1,104; December, 1,608; January (1897), 1,805; February, 1,751; March, 3,547; April, 2,941; May, 2,427; June, 2,395; July, 2,328; August (to the 19th inclusive), 1,396. The balance of receipts over expenditure, taking into account the stock in hand, leaves a very substantial interest upon the capital invested. The sale-book for 1896 shows that 19,900 eggs, 444 hens, and 261 ducklings were sold. The eggs for 1895-6 realised a fraction over 1d. apiece, while the 19,900 were a trifle under. Poultry-keepers ought not to sell March and April (spring) pullets, as many farmers do, for they lay in winter, when eggs are very scarce, and consequently fetch high prices. Penning-up fowls is strongly recommended, because they cannot stray and lay away from home, the eggs are always fresh and quickly gathered, broods are not hatched at the wrong time, and it is easy to see if anything is amiss with the birds. The railway companies have made some very advantageous arrangements to enable farmers to market their produce, and the writer of the article can, 180 miles from London, send eggs here in boxes of ten dozen and upwards at the rate of 1d. a dozen for carriage. Nor in his view is there any reason why producer and consumer should not far more generally be brought into direct relations. The success to be achieved and retained implies that the farmer must in the first place give to his efforts very intelligent supervision and personal help, and in the second instance make his customers feel that they shall always have from him genuinely good and fresh produce.—*Mark Lane Express.*

CANNA DISEASE.

THE *Bulletin of Miscellaneous Information* issued from the Royal Gardens, Kew, warns European gardeners to be careful how they import living *Canna* plants:—"A dangerous disease by which species of *Canna* are quickly destroyed was first recorded from San Paulo, in Brazil, in 1884. Quite recently, an account of the destruction of *Cannae*, by what proves to be the same fungus (*Uredo Cannae*, Winter), has been received from Mr. J. H. Hart, Superintendent of the Botanical Gardens, Trinidad. The diseased leaves are at first thickly studded with minute yellowish spots. This appearance is quickly followed by blackening and death. The disease does not appear to have reached Europe as yet, and great care should be exercised in receiving living plants from the New World, as the fungus, which is closely allied to the Hollyhock Rust (*Puccinia malvacearum*), if once introduced, would in all probability, render impossible the cultivation of *Cannae*, for a time at least."

These handsome plants form such a beautiful feature of our Queensland gardens during the autumn and summer months, that it would be a thousand pities to risk importation which might result in their total annihilation, and we trust that the warning coming from such an eminently reliable source will deter any intending importers from doing so without exercising the most extreme caution.

MAIZE STALKS.

MAIZE-GROWERS, says the *Colombo Agricultural Magazine*, will be interested to learn that at length a discovery has been made that may turn out of incalculable value to growers of the crop. A well-known shipbuilder in Philadelphia (Mr. Cramp) has announced that a chemist, under his patronage, has discovered that, through a certain process, the stalks of maize will furnish material for a large variety of articles, notably paper, matting, smokeless powder, sugar, &c. Hitherto, maize stalks have been of little or no value, except, of course, when a crop has been grown for green food. By this discovery, however, it is alleged that the stalks will be worth at least £1 per acre. In fact, the enormous area of land in America devoted to maize will make this by-product—the stalks—more valuable than cotton-seed, at one time such a nuisance, but now of immense value every year.

RUBBER-TREE GROWING.

THE *Sydney Stock and Station Journal* says:—

A few days ago the Department of Agriculture announced that seeds of rubber-trees would be obtained from Kew Gardens, England, and a trial of them would be made at the Experimental Farms in New South Wales Just prior to that Mr. Campbell, one of the chiefs of the Department, ventured the opinion that rubber-trees were not eminently suited for the New South Wales climate; other experts think differently, so trials are to be made at the Government farms. But let us ask why seeds are to be obtained, and why not trees; also why are they to come from England instead of the countries nearer to our shores, and to which the trees are indigenous? We ask this because we think that, if experiments are needed, they should be of advantage to producers in this, as well as the succeeding, generation. Boomful as rubber is to-day, and secure as it seems in the future as a good payable crop to go for, times, manners, and customs change; and rubber may, by the time the seeds arrive, get into the ground, the trees mature, the rubber juice exudes, and the Government report printed, be a great drug on the market, and nobody the better for the expense, the experiments, and the information gained.

Anyhow, why not go about the matter in the speediest way? As an example, two or three enterprising New South Welshmen have leased a four-square mile island in the Fly River, New Guinea, where the rubber-tree at present grows indigenously, and which they intend to stock right out for rubber. Do you think it would pay them to send to Kew for seeds? Not a bit of it! They send to Java and Ceylon for young trees—trees that will yield 3 lb. of rubber juice in two years. That's business, and there's money in it.

Not many months ago a rubber trader came down from New Guinea in the s.s. "Titus" with two tons of rubber. It cost him £200 to land in Sydney. When here he disposed of it at 3s. per lb.—that is, £336 per ton. The Fly River Island Syndicate brought specimens of rubber from their trees, and were offered £200 a ton as per sample, two or three months ahead, no matter what the then state of the market. Buyers who talk like that don't do anything rash. They know what they are about, and growers who order trees, instead of seeds, want to get some results from their labours before the crack of doom, which means that if our people are to get ahead with rubber-tree growing they'll have to experiment themselves, or they'll get left.

TOBACCO.

Mr. R. S. Neville, Tobacco Expert to the Department of Agriculture, arrived in Brisbane last month, and has entered upon his duties, having already visited Killarney, where tobacco has been largely grown. We hear that several persons are about to again engage in the industry, as they will in future have the benefit of instruction from a thoroughly practical expert.

AGRICULTURAL AND HORTICULTURAL SHOWS.

The Editor will be glad if the secretaries of Agricultural and other Societies will, as early as possible after the fixture of their respective shows, notify him of the date, and also of any change in date which may have been decided on.

SHOW FIXTURES.

Central Downs Agricultural and Horticultural Association (Allora) ... ... 2nd Feb., 1898.

Eastern Downs Horticultural and Agricultural Association (Warwick) ... 9th and 10th Feb., 1898.

Statistics.

RETURN showing QUANTITY and VALUE of HAY and CHAFF IMPORTED into the various PORTS of QUEENSLAND, &c., during the YEAR ended 31st DECEMBER, 1896.

Ports.	Quantity.				Value.		
	HAY.						
	T.	C.	Q.	L.	£	s.	d.
Brisbane ...	371	12	2	2	1,979	0	0
Rockhampton ...	121	11	3	13	683	0	0
Mackay ...	15	15	3	0	90	0	0
Townsville ...	159	4	1	0	929	0	0
Cairns ...	6	0	1	0	51	0	0
Cooktown ...	5	4	2	0	31	0	0
Thursday Island	6	15	3	0	27	0	0
Normanton ...	1	0	2	0	6	0	0
Burketown ...	2	1	1	0	10	0	0
Border Customs	4	0	2	10	20	0	0
	693	7	0	25	3,826	0	0

Ports.	Quantity.				Value.		
	CHAFF.						
	T.	C.	Q.	L.	£	s.	d.
Brisbane ...	1,394	18	1	8	6,678	0	0
Maryborough ...	5	9	3	0	26	0	0
Bundaberg ...	233	19	0	14	1,163	0	0
Gladstone ...	63	4	1	12	446	0	0
Rockhampton ...	1,607	17	1	12	8,656	0	0
Mackay ...	38	12	3	4	186	0	0
Townsville ...	2,497	10	3	0	14,064	0	0
Cairns ...	376	2	3	20	2,447	0	0
Port Douglas ...	25	1	0	16	175	0	0
Cooktown ...	29	4	0	0	167	0	0
Thursday Island	5	11	0	14	28	0	0
Normanton ...	14	0	0	0	109	0	0
Border Customs	65	15	0	12	413	0	0
	6,357	6	3	0	34,558	0	0

The Markets.

AVERAGE PRICES FOR OCTOBER.

Article.		OCTOBER. Top Prices. £ s. d.
Bacon	lb.	0 0 7
Bran	ton	3 18 9
Butter, First	lb.	0 0 $10\frac{1}{2}$
Butter, Second	,,	0 0 6
Chaff, Mixed	ton	3 18 9
Chaff, Oaten	,,	5 7 6
Chaff, Lucerne	,,	3 2 6
Chaff, Wheaten	,,	3 3 9
Cheese	lb.	0 0 $5\frac{3}{4}$
Flour	ton	13 17 6
Hay, Oaten	,,	4 15 0
Hay, Lucerne	,,	1 16 3
Honey	lb.	0 0 $2\frac{1}{16}$
Japan Rice, Bond	ton	13 10 0
Maize	bus.	0 2 $1\frac{1}{2}$
Oats	,,	0 3 5
Pollard	ton	3 14 $4\frac{1}{2}$
Potatoes	,,	5 16 3
Potatoes, Sweet	,,	2 13 9
Pumpkins	,,	2 7 6
Sugar, White	,,	15 15 0
Sugar, Yellow	,,	13 5 0
Sugar, Ration	,,	12 0 0
Wheat	bus.	0 5 6
Onions	cwt.	0 15 3
Hams	lb.	0 0 8
Eggs	doz.	0 0 $5\frac{1}{8}$
Fowls	pair	0 4 $2\frac{1}{4}$
Geese	,,	0 6 $4\frac{1}{2}$
Ducks, English	,,	0 4 0
Ducks, Muscovy	,,	0 4 9
Turkeys, Hens	,,	0 7 $3\frac{3}{4}$
Turkeys, Gobblers	,,	0 15 $7\frac{1}{2}$

Farm and Garden Notes for December.

The wheat harvest will now be in full swing, and every effort should be made to get in the harvest speedily. Barley should be allowed to ripen in the field before cutting, but should be harvested as soon as the grain is hard, otherwise loss will be sustained by scattering. There being a probability of showery weather, care should be exercised in stooking, as a shower of rain will discolour what is left on the ground. After stacking, which should only be done when the barley is absolutely dry, it should remain from six weeks to two months in the stack before being thrashed. Maize may still be sown in large areas. Sow sorghum, imphee, Kaffir corn, and panicum. Arrowroot, ginger, and sweet potatoes may be planted.

Too much care cannot be exercised in protecting newly dug potatoes from the sun. They should be dug as soon as the skin is firm, as they will rot if left in the ground too long during the great heat of this month. They should be dug early in the morning before the sun has gained great power, and carted to a barn, where they should be spread out to cool. Tobacco must be attended to in the manner described last month. Keep all crops clean, and thin them out if too crowded.

Kitchen Garden.—Gather French beans, cucumbers, melons, vegetable marrows, &c., as soon as they are fit for use. Even if they are not required, still they should be gathered, as the plants will leave off bearing otherwise. Sow cabbage and cauliflower seed for early plants. Some difficulty will be experienced in getting the seed to grow at this season, but if sown in a shady place and well cared for they will succeed, and the plants will be proportionately more valuable. French beans, tomatoes, mustard and cress, radish, &c., may be sown. All rubbish should be removed, and either dug under or burnt, as rubbish heaps, stumps, &c., form excellent harbour for all sorts of insect pests.

Flower Garden.—As the grass lawns are the chief attraction, care should be taken to keep them closely mown and all weeds taken out. Keep all the walks clear of weeds. Perpetual roses may be cut back so as to obtain fresh wood for bloom. Cut petunias well back, as they will be getting unsightly by this time. Keep all straggling plants staked and tied. Dahlias will require thinning and tying. Zinnias, balsam, marigolds, cockscomb, amaranthus, calendula, gaillardia, and coreopsis may be still sown, if not already sown during the previous month.

Orchard Notes for December.

BY ALBERT H. BENSON.

IN the Orchard Notes for November, I called special attention to the importance of marketing fruit properly, emphasising the necessity for careful handling, even grading, and attractive packing if satisfactory prices are to be obtained. Those remarks apply equally to the present month or, in fact, to any month of the year, as there is always more or less fruit of one variety or another to be marketed; and it is simply wasting time and money cultivating, pruning, manuring, or spraying an orchard—in fact, doing everything possible to produce good fruit—if when the fruit is grown it is not put on the market in such a manner that it will realise the highest price. Careful handling, grading, packing, and marketing will secure a ready sale for good fruit in any market, even when the same fruit badly handled and unattractively got up would be unsaleable. Growers would do well to take a lesson in packing from the Californians, who have been shipping apples, or from the Italians, who are shipping lemons to this colony, as those fruits, even after a long and trying voyage and one or more transhipments, reach here in better condition and in a much more attractive state than our local fruit, which is often only carted a few miles.

Keep down pests wherever met with; gather and destroy all fly-infested fruit. Destroy orange bugs before they become mature by hand-picking or by driving them to the trunks of the trees, by tapping the outer branches with light poles, the insects being brushed off from the trunks and main branches on to a sheet placed under the tree to catch them, from which they can be easily gathered and burnt.

All caterpillars, cut-worms, beetles, grasshoppers, crickets, or other insects destroying the foliage should be destroyed by either spraying the same with Paris green, 1 oz. to 10 gallons of water, or by dusting them with a mixture of Paris green and air-slacked lime, 1 oz. of Paris green to 5 lb. of lime. Keep the orchard well cultivated, especially in the dry districts; and where there is water available for irrigation, in such districts all citrus-trees should receive a watering during the month unless there is a good fall of rain, when it will be of course unnecessary.

Pineapples, bananas, and other tropical fruit can be planted during the month, showery weather and dull days being chosen. The rainy season is the best time to transplant most tropical plants. Where it is desirable to go in for green crop manuring, or for raising a green crop for mulching, cow-peas can be sown, as they will be found to make a very rapid growth now, which will be strong enough to keep most weeds in check.

See that all surface and cut-off drains are in good working order, and not choked up with grass, weeds, &c., as heavy rain may fall during the month, and there should be a get-away for all surplus water, which would tend to either wash the soil or sour it; stagnant water round the roots of the trees being exceedingly injurious at any time, and especially so during the heat of summer.

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